



THE
FIFTH ANNUAL REPORT
OF THE
RESEARCH DEPARTMENT
OF THE
INDIAN COFFEE BOARD
(1951-52)



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73	33	„ VIII	„	V
74	29	„ IX	„	VI
78	9	„ July 1951	„	July
78	15	„ January 1952	„	January

CONTENTS

	PAGE
I. INTRODUCTORY	
Administration	1
Extension activities	1
Season and Crop	2
II. RESEARCH	
A. BOTANY	
Breeding (i) Arabica	3
(ii) Robusta	8
Extension work with selections	10
Regional nurseries	11
Vegetative propagation	12
B. CHEMISTRY	
Permanent Manurial experiments at Balehonnur ...	16
Co-operative manurial experiments at Kirgandur ...	19
—do— —do— Gargandur ...	20
Bulky <i>v.</i> Concentrated manurial expts. Boothanhadloo...	20
Catalyzation of plant nutrients	21
Fundamental Manurial experiments at Balehonnur ...	24
Manurial experiments on robusta	25
<i>E. lithosperma</i> (dada) pruning experiment	30
Study of soil profiles	30
Analysis of green manures	33
Abnormal leaf fall,—analysis of coffee leaves ...	37
C. AGRONOMY	
Influence of pruning on yields	39
Pruning and manurial expts. on robusta	41
The study of basic yields for standardization of experimental plots	41
Replicated trials of agronomic practices	42
Single <i>v.</i> Multiple stem of growing coffee	44
Effect of <i>Dicotox</i> (weed killer) on coffee	45
Studies in the germination of coffee seeds	46
Mulching experiments	48
Topping experiments on robusta	49
Conditions favouring vegetative propagation of coffee ...	49
D. PLANT PROTECTION	
Time and Strength of Bordeaux spray	57
Relative merits of various copper fungicides with wettters and spreaders	60
Bordeaux mixture <i>v.</i> Copper sandoz	62
Coffee pests, White stem borer	63
Control of green bug	64
Coffee eelworm	69

	PAGE
E. ROBUSTA PULPING EXPERIMENTS ...	70
III. EXTENSION SERVICE ...	71
IV. MISCELLANEOUS CROPS ...	72
V. FARM MANAGEMENT ...	73
VI. GENERAL ...	74
Trials with spray nozzles ...	74
Meteorology ...	74
Appendices ...	74 to 77

INDIAN COFFEE BOARD

(Research Department)

THE FIFTH ANNUAL REPORT OF THE RESEARCH DEPARTMENT OF THE INDIAN COFFEE BOARD

(1951-1952)

I. INTRODUCTORY

1. **Administration.** I continued to be in charge of the Research Department throughout the period under report except for 12 days when I was on earned leave. Dr. N. G. Chokkanna was Chemist except for a period of 37 days when he was on leave; Sri S. Sundaram continued to be the Agronomist at Headquarters except for 28 days during which period he availed leave; Sri R. L. Narasimhaswamy continued as Assistant Botanist throughout the period. Sri S. V. Kuppuswamy joined duty as Assistant Chemist on 3-10-1951 and continued till the end of the year under report during which period he was given 15 days leave. Sri T. V. Pattabhiraman continued as Liaison Officer with headquarters at Chethalli and was in charge of the field Experiments in Coorg throughout the year under report. Sri James Colaco was Superintendent at the Sub-Station, Chethalli, except for 21 days when he was on leave. One additional fieldman appointed under the 5 year plan joined duty on 3-8-1951. A list of staff as on 30-6-1952 is given in appendix I.

2. **Extension and Expansion Activities.**

(a) **Balehonnur:** There was no fresh major building construction at Balehonnur during the year under report. However, a small room to accommodate the new Aerogen gas generator was constructed on one side of the main laboratory and the gas mains laid. A small shed for storing inflammable materials was nearing completion. A well was constructed to serve the needs of the laboratories, the Director's bungalow and the new bungalows proposed to be constructed on high level areas. An area of 2 acres 50 cents was planted with clonal material from latest selections of arabica (BA 1 to 36) and robusta (BR 1 to 17) and an area of 66 cents was planted with special crosses made during the previous year. The total area under clonal material and special crosses for seed purposes has thus been increased to 3.16 acres.

(b) **Chethalli:** Two senior staff quarters and two blocks of four junior staff quarters were completed at the beginning of the year. As the size of the existing well from which water was being pumped for the domestic consumption of the station residents was too small to meet the requirements, the well was extended. In spite of the extension there was not sufficient water during the hot months of May and June and hence the suction pipe had to be connected to a perennial channel in the wetlands nearby. Seven acres of old coffee cleared during 1949-50 were planted up with first generation seedlings of the families S.288, S.333, S.645 and S.795 and with 669 clonal plants raised from arabica and robusta cultures. An area of 4 acres of jungle was cleared and was planted during the season following with seedling material for conducting manurial experiments.

3. Season and Crop.

(a) **Balehonnur**: The year under report (July 1951 to June 1952) recorded a rainfall of 92.35 inches as against the previous decennial average of 106.72 inches. The deficit occurred during the S.W. monsoon period to the extent of 13 inches due to two spells of bright weather intervening during the first half of July and towards the last week of August. The monsoon set in again in September, but tailed off producing sporadic showers up to the third week of November. Nevertheless, there were sporadic outbreaks of black-rot during the end of July and the beginning of August. Incidence of leaf disease was rather early after the S.W. monsoon, but was checked by timely spraying. Borer infestation on arabica was about 4 per cent. Green bug was confined to stray patches in the new plantings. Robusta suffered from shot-hole borer and from partial shedding of leaves during the heavy S.W. monsoon period. The weather was practically dry from the third week of November to the third week of February except for a shower of 14 cents in January which caused incipient opening of some robusta spikes. The crop for 1951-52 was 14.38 tons as against the final estimate of 12 tons. On the 21st February, 1.27 inches of rain was received followed by 23 cents in the next few days. There were no backing showers and the next rain was received after a lapse of $1\frac{1}{2}$ months on 10th April amounting to 27 cents. The blossom showers occurred about a month earlier than usual at a time when some of the spikes were not well developed. The mature spikes opened out, but having a long period of 7 weeks without rain a high percentage of it failed to develop. One distinctive feature of this year's blossom was that it lasted through three days, the major blossom opening on the 9th day and succeeding days producing a substantial percentage of flowers. The prospects for robusta during the current season are more favourable due to the substantial blossom showers received in February. The estimate made on blossom for the year 1952-53 is 10 tons of arabica and $3\frac{3}{4}$ tons of robusta.

(b) **Chethalli**: The rain during the period 1-7-51 to 30-6-52 was 62.30 inches as against the previous decennial average of 71.62 inches. Despite the good blossom showers of 1.75 inches received on 24th March 1951 followed by 13, 15 and 14 cents on the 26th, 27th and 28th March, the crop proved to be much lower than the estimate. A total of 5.85 tons were picked as against an estimate of 11.5 tons. Owing to several dry spells during the monsoon period and the occurrence of a long hot weather of severe drought conditions, the incidence of white stem borer was quite marked during the fag end of the year under report. The period from 23-11-51 to 7-4-52 (136 days) was completely rainless except for 5 cents on 21-2-1952 and 4 cents on 23-2-1952 which did not bring out the blossom. The blossom showers were sporadic, the rainfall being 15 cents on 7-4-1952, 4 cents on 8-4-1952, 30 cents on 11-4-1952 and 62 cents on 12-4-1952. Nevertheless, the cumulative effect has been good with the result that there was a full uniform blossom on the 19th and 20th April. The crop for the year is estimated at 8 tons of arabica and $\frac{1}{2}$ ton of robusta.

The meteorological data recorded on both the stations are given as appendices, II, III and IV.

II. RESEARCH

A. BOTANY

4. Botanical work on coffee progressed on lines similar to those followed in the previous years. Emphasis was laid on (1) production of hybrid seeds from controlled pollination of parents that are known to produce vigorous progeny, (2) vegetative propagation of clonal material from outstanding bearers, (3) comparative trials of clonal plants from the best performers for

eventual isolation of the best and (4) a search of best bearers in private estates. The outstanding achievement was the commencement of a randomised lay-out for comparing the clonal progeny of arabica and robusta cultures selected on the basis of their yield performance during the year 1949-50 with a view to single out the best performers among these for later multiplication and distribution to growers. Vegetative propagation was continued and in addition to raising clonal progeny of selected arabica and robusta cultures mentioned above, clonal progeny of 40 selected Kent plants were raised and utilized for laying out a manurial experiment.

Breeding :

Arabica

5. At Balehonnur, hybridisation and selfing of selected plants were continued. The hybridisation has been carried out with a view to get the best combination that gives progeny with desirable characters as growth vigour, yield and leaf disease resistance. Selfing was carried out with the hope of isolating homozygous plant material. The early blossom showers received in February came in the way of carrying out effective and large-scale hybridisation programme. Details of work done are given below :—

TABLE I — Breeding of arabica coffee at Balehonnur (Mysore)

No.	Method.	Purpose.	Procedure adopted.
1.	Hybridisation between two desirable parents.	To secure best combination to produce highest yield and vigour.	(a) 583'1/9 × S. 26. (b) do × 327'3/10. (a) 583'6/11 × 583'1/9. (b) do × 327'3/10. (a) 327'3/10 × 583'1/9. (b) do × 644'1/13. (a) 580'2/13 × S. 26. (b) do × 327'3/10. (c) do × 645'1/6. 645'1/6 × 583'1/9. S. 31 × S. 22. S. 31 (Graft) × S. 22.
2.	Selfing of desirable selections.	To produce seed for raising further progeny and for supplies to planters.	28 plants in 288 family (sibs 1-28) were covered with muslin bags when they were in blossom. 38 plants in 645 family (sibs 1-38) were covered with muslin bags when they were in blossom. 28 plants in 795 family (sibs 1-28) were covered with muslin bags when they were in blossom. 11 plants in 333 family (sibs 1-11) were covered with muslin bags when they were in blossom.

6. At Chethalli, observations were continued on foundation stocks of breeding material from the first generation seedlings raised from selections obtained from Balehonnur and Ghhatedhulla. The details of these observations are given below :—

TABLE II — Observations on arabica coffee at Chethalli (Coorg)

1949 PLANTINGS				Remarks.	
No.	First Generation of	Procedure adopted.			
1.	S. 288, S. 795, S. 645, S. 531 × Kents, S. 26 × Kents.	Grown in non-repli- cated blocks.		S. 531 × Kents and S. 795 were more vigorous than others.	
2.	S. 288, S. 795, S. 645, S. 446.	Latin square :—		Yield per acre	
		446	795 645 288	Fruit	Clean
		645	446 288 795		Coffee
		795	288 446 645	lb.	cwt.
		288	645 795 446	A. S. 288	0.20
				B. S. 645	0.29
				C. S. 795	0.38
				D. S. 446	1.30
				Mean	0.54
				S.E.M. %	23.48
				Sig. or not	Yes.
				Critical	
				difference	191 0.43
				Conclusion	D, C, B, A
		Original number	S. 288 S. 645 S. 795 S. 4-6		
		planted ...	384 384 384 384		
		Plants diseased and			
		subject to extensive			
		defoliation ...	55 16 9 43		
		Disease spots present but			
		negligible defoliation. ...	8 10 13 214		
		Plants lost due to various			
		causes. ...	135 102 74 27		
		S. 446 in general is quite outstanding so far as yield is concerned. Supply losses were least, but fails to be statistically significant. Disease spots present in Jan.- Feb., but not followed by extensive defoliation.			
3.	S. 702, S. 838.	Non-replicated plots.		Free from disease but not equal to 446 in vigour.	
4.	Rooted cuttings from S. 645, S. 31 and S. 795.	There were only 32 plants in these series.		In all 11 plants died. The rest have a large number of primaries right from the ground and are bearing a heavy crop this year.	

1950 PLANTINGS					
First genera- tion of	Original number planted	Deaths upto Nov. 52	Supplies made dur- ing 52	Total of old and young plants	Remarks
5. S. 288	166	30	24	160	There was considerable mortality in all, parti- cularly in 645 due to supply losses and borer.
S. 645	736	231	102	607	
S. 795	736	34	66	768	
S. 838	256	29	29	256	
S. 702	183	13	18	188	
Total	2077	337	239	1979	

1951 PLANTINGS			
6. S. 288, S. 333, S. 645, S. 795	Non-replicated. 288=1438; 333=791; 645=2006; 795=2210.		Not many supply losses. The plants in general are quite vigo- rous especially S. 795.
7. Arabica and robusta rooted cuttings in- tended for manurial experiments.	Planted in the field 6½ × 6½ in August 1951— Arabica ... 109 Robusta ... 461		Due to failure of rain after plant- ing, 58 cuttings died during 1951-52.
	Total	570	

7. **Devamachi hybrids.** The plants from seed material from 8 inter-specific hybrids between arabica and robusta, planted in 1949 progressed satisfactorily and are bearing crop. There were considerable losses in the fresh batch of hybrids, crossed among themselves, but those crossed with Kents and planted in 1950 survived.

8. Field studies of advanced generation of hybrids.

(a) The following were planted in a 'rubbish heap' block at Balehonnur (Mysore).

<i>Seedlings produced from</i>	<i>No. of seedlings planted</i>
4th gen. of S. 26 x (F ₈ of 288 x var. maragogyne) and reciprocal	105
S. 26 x 580·2/16	43
4th and 5th selfed gen. of S. 26	505
F ₂ of (S. 26 x Kent)	25
F ₈ of (288 x Kent)	618
763·2/8 x 288-23	5
S. 31 x 583·5/16	50
S. 31 x 580·2/16	31
S. 31 x 583·3/7	18
S. 31 x 583·1/9	35
2nd and 3rd selfed gen. of (S. 31 x S. 22)	527
333·4 x 786·1/13 and reciprocal	64
333·4 x 778·2/19 and reciprocal	87
773·2/15 x 333-4	8
779·2/10 x 333-8	22
776·1/12 x 645·2/11	8
558·9/1 x 333-4	2
3rd self. gen. of S. 44	138
559·9/1 x 573·3/7	9
574·3/7 x 558·9/1	6
574·3/7 x 775-1	15
1st selfed gen. of S. 72	100
1st selfed gen. of 583	254
1st selfed gen. of 585	300
Total	2,975

(b) *Comparative trials of clonal plants from best performers*: Clonal progeny from 20 arabica cultures of the B.A. series were planted in a randomised replicated experiment. As the number of clonal plants in each culture was limited, the replications were limited to three during the planting season in August 1951. Later they were increased to eight in July '52. The layout is given below:—

<i>Locality</i> : Balehonnur (Mysore)	<i>Layout</i> : Randomised block.
<i>Variety</i> : Arabica (Hybrids)	<i>Plot</i> : 3 plants in a row.
<i>Treatment</i> : 20 cultures of BA series.	<i>Guard rows</i> : One on either side.
<i>Replication</i> : 8.	<i>Spacing</i> : 6' x 6'.
<i>Area of experimental block</i> : 59·5 cents.	<i>Shade</i> : Natural shade.

On account of the late planting in August 1951 and due to continued long drought in the succeeding dry and hot weather, 23 plants died of which 20 plants were from the border rows. Timely hand-watering helped the plants generally in withstanding the adverse effects of the drought.

(c) 1071 seedlings from crosses and 334 seedlings from 3 selected plants of the families 288 and 333 were raised in the nursery at Balehonnur.

9. Grading of arabica selections according to size and shape. The importance of grading coffee according to size and shape is a recognized market practice. With a view to classify the latest arabica selections (BA series) according to their bean size and shape, 50 flat beans were taken at random from 31 cultures and precise measurements were taken of their length and breadth. It was found that the 31 single plant cultures can fall into three grades.

TABLE III—Character studies of arabica selections

CULTURE	AVERAGE OF 50 BEANS MEASUREMENTS IN MM.				Ratio of length/ breadth
	Length	Standard error	Breadth	Standard error	
B.A. 1	9.7	+ 1.0	7.8	+ 0.06	1.24
B.A. 2	9.7	+ 1.0	7.3	+ 0.02	1.33
B.A. 3	9.9	+ 2.0	7.7	+ 0.07	1.29
B.A. 4	9.8	+ 0.1	7.4	+ 0.09	1.32
B.A. 5	9.8	+ 0.1	7.3	+ 0.05	1.36
B.A. 6	10.2	+ 0.09	7.3	+ 0.05	1.397
B.A. 7	10.6	+ 0.02	7.9	+ 0.08	1.34
B.A. 8	9.7	+ 0.2	6.9	+ 0.1	1.40
B.A. 9	9.3	+ 0.09	7.2	+ 0.06	1.29
B.A. 10	10.0	+ 0.01	7.5	+ 0.08	1.33
B.A. 11	9.8	+ 0.09	7.4	+ 0.06	1.32
B.A. 12	9.3	+ 0.08	7.1	+ 0.1	1.31
B.A. 13	9.5	+ 0.09	7.4	+ 0.07	1.28
B.A. 15	9.2	+ 0.12	7.1	+ 0.07	1.296
B.A. 16	9.8	+ 0.07	7.4	+ 0.02	1.32
B.A. 17	8.4	+ 0.12	6.9	+ 0.07	1.217
B.A. 18	8.6	+ 0.1	6.9	+ 0.07	1.246
B.A. 19	9.2	+ 0.01	6.9	+ 0.08	1.333
B.A. 21	9.8	+ 0.13	7.9	+ 0.09	1.24
B.A. 22	9.6	+ 0.32	8.1	+ 0.01	1.185
B.A. 25	8.9	+ 0.39	6.9	+ 0.19	1.29
B.A. 26	11.2	+ 0.13	7.1	+ 0.09	1.577
B.A. 27	10.3	+ 0.19	7.3	+ 0.12	1.411
B.A. 28	11.2	+ 0.20	8.1	+ 0.15	1.38
B.A. 29	9.8	+ 0.23	7.7	+ 0.14	1.27
B.A. 31	10.9	+ 0.18	7.5	+ 0.1	1.446
B.A. 32	10.2	+ 0.09	6.5	+ 0.07	1.585
B.A. 33	9.7	+ 0.06	7.0	+ 0.09	1.385
B.A. 34	9.9	+ 0.11	7.2	+ 0.07	1.375
B.A. 35	9.5	+ 0.08	7.6	+ 0.06	1.25
B.A. 36	8.5	+ 0.09	7.4	+ 0.07	1.148

The following shows the cassification of the 31 cultures for bean size and shape. The figures in brackets indicate the old family number with the position of the plant in the field :—

Longish : B.A. 5 (329-6/12) ; B.A. 6 (329-6/14) ; B.A. 7 (370-1/2) ;
B.A. 8 (327-2/10) ; B.A. 26 (353-8/15) ; B.A. 27 (353-7/6) ;
B.A. 28 (353-9/13) ; B.A. 31 (585-1/14) ; B.A. 32 (373-1/3) ;
B.A. 33 (526-4/15) ; B.A. 34 (434-4/11).

Roundish Oblong : B.A. 2 (288-2/7) ; B.A. 4 (329-3/4) ; B.A. 10 (327-4/15) ;
B.A. 11 (327-5/5) ; B.A. 16 (333-8) ; B.A. 19 (645-1/6) ;
B.A. 22 (583-2/4) ; B.A. 25 (583-7/14) ; B.A. 29 (576-1/2).

Roundish : B.A. 1 (288-2/5) ; B.A. 3 (288-2/9) ; B.A. 9 (327-3/10) ;
B.A. 12 (327-6/4) ; B.A. 13 (333-4) ; B.A. 15 (333-7) ;
B.A. 17 (333-14) ; B.A. 18 (333-15) ; B.A. 21 (583-1/9) ;
B.A. 35 (S. 26) ; B.A. 36 (S. 31). Of these the beans of the
following are small :—
B.A. 9 (327-3/10) ; B.A. 12 (327-6/4) ; B.A. 15 (333-7) ;
B.A. 17 (334-14) ; B.A. 18 (333-15) ; B.A. 36 (S. 31).

It will be noticed that the individual plant selections made from the same plant family do not always fall within the same classification.

10. **Selections from private estates.** (a) Recording of yield and analysis of the crop from the preliminary selections marked out in Gundicaud block of Netraconda estate (Mysore) were continued and the data are given in the following table :—

TABLE IV—Character studies of preliminary selections from Netraconda estate (Mysore)

		SELECTION					
		Net. A	Net. B	Net. C	Net. D	Net. E	Net. F
Actual yield of ripe cherry in oz.							
	1950 ...	49	307	304	206	82	158
	1951 ...	128	32	54	13	6	48
	1952 ...	56	64	50	204	66	74
	<i>Average</i> ...	77.7	134.3	136.0	171.0	51.3	93.3
Calculated yield of clean coffee per acre in cwt. (1200 plants)							
	1950 ...	7.3	18.7	26.1	30.2	10.2	16.0
	1951 ...	19.5	3.6	3.6	2.0	0.7	4.7
	1952 ...	6.0	6.5	4.2	22.8	6.8	7.3
	<i>Average</i> ...	10.9	9.6	11.3	18.3	5.9	9.3
Percentage triage							
	1950 ...	15.8	12.6	36.0	31.3	14.3	10.5
	1951 ...	10.3	10.0	7.3	29.7	5.3	28.6
	1952 ...	14.3	8.3	4.8	20.6	5.3	16.6
	<i>Average</i> ...	13.5	10.3	16.0	27.2	8.3	18.6
% A grade beans							
	1950 ...	28.6	17.5	42.7	31.3	39.3	46.3
	1951 ...	37.9	30.0	40.0	41.6	55.0	42.8
	1952 ...	50.0	50.0	66.7	61.1	68.4	52.4
	<i>Average</i> ...	38.8	32.5	39.8	44.7	54.2	37.2
% peaberry							
	1950 ...	28.6	30.2	15.7	13.5	18.6	25.9
	1951 ...	37.9	20.0	22.9	7.1	40.0	14.2
	1952 ...	32.1	16.7	23.1	16.8	21.1	31.5
	<i>Average</i> ...	32.9	22.3	20.6	12.5	26.6	23.9
Weight of 100 A grade beans in gms.							
	1950 ...	21.6	19.2	22.0	20.5	20.5	22.2
	1951 ...	20.9	20.0	19.6	21.9	...	20.3

Note.—Clean coffee is calculated on the actual out-turn of coffee from ripe cherry harvested.

On account of low yield, high triage, or both, selections E & F have been discarded.

(b) (i) Seeds of robusta and arabica (hybrid) plants were collected from marked plants in private estates and seedlings raised from these at the Station. Details of seedlings raised are given below :

<i>Estate.</i>	<i>Selection.</i>	<i>No. of seedlings raised.</i>	
Kurkenmuttery	Arabica Hyb. 1	...	97
"	" " 2	...	80
"	" " 3	...	99
"	" " 4	...	90
Lalbagh	" " 1	...	60
"	" " 2	...	70
Moganaad and Cauvery peak		...	25

(ii) Seedlings raised from seeds collected last year from marked plants in private estates have been planted in small observational plots at the Station :—

<i>Estate.</i>	<i>Selection.</i>	<i>No. of seedlings planted.</i>		<i>Remarks.</i>
Kurkenmuttery	Arabica Hyb. 1	8	}	Seedlings are showing resistance to leaf disease and are having vigorous growth.
"	" " 2	20		
"	" " 3	24		
"	" " 4	14		
Kelganne	Arabica Hyb.	42	}	Seedlings are having vigorous growth.
Chikanahally	" "	24		
Bhadra	Robusta 1	13		
"	" 2	79		
Kumergode	Robusta	109		
Chikanahally	Robusta	21		

Robusta

11. Comparative trials of clonal plants from best performers.

Clonal progeny of ten robusta cultures were planted in randomised replicated plots. As the number of clonal plants in each culture was limited the replications were limited to five during the planting season of August 1951 and later they were increased to nine during July 1952. The lay-out is given below :—

<i>Locality:</i> Balehonnur (Mysore)	<i>Layout:</i> Randomised block.
<i>Variety:</i> Robusta	<i>Plot:</i> 3 plants in a row.
<i>Treatments:</i> 10 cultures of BR series.	<i>Guard rows:</i> One on either side.
<i>Area of experimental plot:</i> 95 cents.	<i>Spacing:</i> 9' x 9'.
	<i>Shade:</i> Natural shade.

12. Grading of robusta selections according to size and shape. A study of measurements of length and breadth of beans of 15 robusta cultures of B.R. series was commenced. For this purpose 50 beans were taken at random and their length and breadth measurements were recorded. Averages, standard error as well as length/breadth ratios were worked out. The data are presented below :—

TABLE V—Character studies of robusta selections

CULTURE	AVERAGE OF 50 BEANS MEASUREMENTS IN MM.					Ratio of length/ breadth
	Length	Standard error	Breadth	Standard error		
B.R. 1	...	8.5	+ 0.07	6.8	+ 0.05	1.25
B.R. 2	...	9.2	+ 0.07	7.7	+ 0.04	1.19
B.R. 3	...	8.4	+ 0.09	6.4	+ 0.07	1.31
B.R. 4	...	8.7	+ 0.06	6.0	+ 0.05	1.45
B.R. 5	...	8.8	+ 0.07	6.0	+ 0.05	1.46
B.R. 6	...	8.3	+ 0.08	6.5	+ 0.06	1.28
B.R. 7	...	8.8	+ 0.15	7.1	+ 0.08	1.24
B.R. 8	...	10.9	+ 0.17	6.9	+ 0.09	1.58
B.R. 9	...	8.9	+ 0.07	7.1	+ 0.06	1.25
B.R. 10	...	8.9	+ 0.08	6.6	+ 0.05	1.35
B.R. 11	...	9.5	+ 0.07	7.4	+ 0.06	1.27
B.R. 12	...	9.2	+ 0.08	7.1	+ 0.06	1.30
B.R. 13	...	8.0	+ 0.09	6.9	+ 0.05	1.16
B.R. 14	...	8.7	+ 0.07	6.4	+ 0.06	1.36
B.R. 16	...	9.1	+ 0.07	7.4	+ 0.06	1.23

The following shows the classification of the selections for bean size and shape. The figures in brackets indicate the family number with the position of the plant in the field:—

Longish : B.R. 4 (270-3/12) ; B.R. 5 (270-4/9) ; B.R. 8 (274-1/6)
B.R. 10 (274-2/12) ; B.R. 14 (276-2/6).

Roundish Oblong : B.R. 1 (267-1/12) ; B.R. 2 (268-1/7) ; B.R. 3 (269-2/6) ;
B.R. 6 (272-3/10) ; B.R. 7 (273-1/7) ; B.R. 9 (274-1/10) ;
B.R. 11 (274-3/13) ; B.R. 12 (275-3/9) ; B.R. 13 (275-3/7) ;
B.R. 16 (277-3/7). Of these the beans of the following are small :—
B.R. 2 (268-1/7) and B.R. 13 (275-3/7).

Here again the importance of individual plant selections is emphasised.

13. Eight trees at Ghattedhulla (Coorg) recorded below, had proved their merit by the regularity of bearing and high average yields varying from 203 oz. per plant against a field average of 61 oz. in the years 1940-41 to 1945-46. These were divided into two groups and four sets of crosses and their reciprocals were effected in 1948. Plants from these were put in at Chethalli in 1949. Further crosses between F_1 of A x B and F_1 of C x D are indicated during the next blossom.

TABLE VI—Intraspecific hybrids of robusta (Chethalli)

Crosses	Procedure adopted	Remarks
1. Cross A. 52-33 × 58-31 Reciprocal a 58-31 × 53-33...	Direct and reciprocal crosses planted alternately in the same line.	All are of fairly good vigour and free from leaf disease. No perceptible difference between direct and reciprocal crosses.
2. Cross B. 59-9 × 58 -16 Reciprocal b. 58-16 × 39-9 ...	A crosses Planted in lines alternating with B.	There were 9 plants with bronze coloured leaves out of 100 crosses.
3. Cross C. 49-28 × 53 -28 Reciprocal c. 52-28 × 49-28...	C. crosses planted in lines alternating with D.	The mother plants of 53-28 and 49-28 at Ghattedhulla are known to have lately become susceptible to leaf disease, but the crosses between these plants have given disease free plants.
4. Cross D. 63-8 × 46 -20 Reciprocal d. 46-20 × 63-8 ...		Most of these blossomed.

14. **Progeny of Ghattedhulla robusta selections at Pollibetta (Coorg).** Open pollinated seeds from robusta trees selected at Ghattedhulla were sown in 1943 April, and a clearing raised at Pollibetta. The progeny of the different selections were brought under observation for yield characters. This involves observations on roughly 1900 robusta trees for total yield of fruit, number of fruits per pound and the percentage number of *floats*. The second year of observation was completed this year.

15. **Extension work with selections.** The demand for seed of several families of coffee selections of arabica and robusta has been on the increase. Though the method of collecting seed from a number of individuals from the same family is not the ideal, the system has to be pursued until such time as when clonal plants of the best are sufficiently multiplied. It has not been possible to meet all the demand, but every effort was made to collect more seed material from tolerably desirable plants year after year. As against the supply of 150 lb., 253 lb. and 400 lb. of seeds during 1949, 1950 and 1951 respectively, 695 lb. 13 oz. of seeds were supplied during this year. The following table furnishes details :—

TABLE VII—Quantities of seed coffee collected for distribution

Selections		Quantity.		Total.	
		lb.	oz.	lb.	oz.
Arabica					
Bulked seed from family	S. 288	...	343 0		
	S. 333	...	191 14		
	S. 645	...	17 8		
	S. 795	...	17 3		
	S. 644	...	0 8		
	S. 583	...	0 2		
	Kents	...	80 9	650	12
Robusta					
Bulked seed from family 274		...	45 1	45	1
Total		...		695	13

Besides supplies of seeds from the above families, 1139 lb. of robusta seeds from selections made on nearby private estates were sold to indentors.

16. The following table shows supplies of seed coffee according to areas and it will be seen that all the coffee growing areas have been supplied :—

TABLE VIII—Distribution of seed coffee

Sl. No.	A R E A S	Quantity of seeds of selections				Quantity of seeds of			
		Arabica		Robusta		Kents		Robusta	
		lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
1	Bababudangiri	... 143	12½	6	11½	...	...	104	5
2	Aldur	... 0	13	...	...	...	...	14	4
3	Mudigere	... 49	12	6	13½	3	3	60	8
4	Saklespur	... 44	7½	2	8	3	0	98	10½
5	Hassan	...	...	...	...	10	0	11	0
6	Belur	... 37	1	1	14	...	...	18	0
7	Balehonnur-Koppa	... 29	8	6	5½	0	2	36	0
8	Sagar-Thirthahalli	... 2	0	0	5	...	...	...	...
9	Biligiris	... 3	10	...	...	...	...	...	...
10	Coorg	... 164	11½	10	7½	22	8	238	10
11	Nilgiris	... 50	14	2	3	18	0	151	0
12	Malabar-Wynaad	... 0	6½	1	9	1	0	183	9
13	Travancore	... 6	4	...	...	1	12	164	9
14	Cochin	... 1	0	0	15	...	...	35	0
15	Shevaroys	... 26	2	4	13	2	0	4	0
16	Coimbatore	... 5	0	...	...	...	...	...	...
17	Tirunelveli	...	...	...	...	...	...	6	0
18	Vishakhapatnam	... 2	0	...	...	...	...	...	...
19	Madhyapradesh	... 1	0	...	...	...	...	1	0
20	Manipur	... 0	8	...	...	...	...	0	8
21	Burma	...	...	...	...	...	...	2	8
22	Pakistan	... 1	0	0	8	10	0	10	0
23	Sudan	...	...	...	...	8	0	...	...
24	Uganda	...	...	...	...	1	0	...	...
Total		... 569	14	45	1	80	9	1139	7½

17. **Regional nurseries.** Out of 14 regional nurseries functioning in the previous year four became defunct. One additional nursery was started at Mandalkan estate (Mysore). There was a great demand for seedlings from these nurseries. The following table gives the quantities of seeds supplied to the nurseries during the year, number of seedlings raised in them as at the end of the year and the number of seedlings distributed to planters. A sum of Rs. 987-14-0 was realised by sale of seedlings from the nurseries and Rs. 1,315-15-2 was paid to the estates and Government agencies towards the cost of raising and maintaining the nurseries.

TABLE IX—Seeds supplied to regional nurseries, seedlings raised therein as at the end of the year and seedlings distributed to planters during the year.

REGIONAL NURSERY	ARABICA SELECTIONS						Rob- usta S. 274	TOTAL
	288	333	645	795	S. 26 × Kent	531 × Kent		
MYSORE								
1 Murkull estate, Javali.								
Seeds supplied oz. ...	16	16	...	...	...	...	32	64
Seedlings raised ...	1000	1000	...	...	...	...	...	2000
Seedlings distributed...				2325			...	2325
2 Mandalkahn estate, Santaveri P.O.								
Seeds supplied oz. ...	16	16	...	...	...	...	32	64
Seedlings raised ...	750	750	...	...	...	...	1500	3000
3 Coffee Research Station, Balehonnur.								
Seeds supplied oz. ...	80	80	...	...	...	...	32	192
Seedlings raised ...	4000	1000	...	...	...	...	...	5000
COORG								
4 Nullore Estate, Sunti- koppa.								
Seeds supplied oz. ...	32	32	...	...	...	...	32	96
Seedlings raised ...	2280	2280	...	...	...	...	1000	5560
Seedlings distributed...	2000	...	1045	513	...	...	1708	5266
5 Madapur estate, Mada- pur.								
Seeds supplied oz. ...	32	32	...	...	...	...	32	96
Seedlings raised ...	600	650	...	...	...	...	800	2050
Seedlings distributed...				1500				1500
NILGIRI-WYNAAD								
6 Glenvans estate, New Hope.								
Seeds supplied oz. ...	16	16	...	...	...	...	...	32
Seedlings raised ...	1000	1050	...	...	...	...	...	2050
Seedlings distributed...				2250			...	2250
NILGIRIS								
7 Adderly estate, Coonoor.								
Seeds supplied oz. ...	16	16	...	...	...	...	...	32
Seedlings raised ...	1200	...	...	...	...	...	...	1200
Seedlings distributed...		2700					...	2700
BILIGIRIS								
8 Honnemetti estate, Attikan P.O.								
Seeds supplied oz. ...	16	16	...	...	...	...	...	32
Seedlings raised ...	...	...	...	...	...	...	...	...
Seedlings distributed...	395	...	480	890	127	180	...	2072
SHEYAROYS								
9 Hawthorn estate, Yercaud.								
Seeds supplied oz. ...	32	...	...	...	...	...	32	64
Seedlings raised ...	2300	...	800	500	...	...	1600	5200
Seedlings distributed...	200	...	250	100	75	115	2000	2740
VISHAKHAPATNAM								
10 Araku Valley Scheme, Araku P.O.								
Seeds supplied ...	16	16	...	...	...	...	...	32

Seeds were supplied free to all the nurseries except the one run by the Araku Valley Scheme (Vishakhapatnam) which purchased the seeds.

Vegetative Propagation

18. Great emphasis was laid on the raising of clonal progeny of 36

arabica and 17 robusta single plant cultures selected during the year 1949-50. A total of 1366 plants were produced from this lot. Besides this, 1039 clonal progeny of selected Kent plants for laying out a manurial experiment, and 1641 from desirable arabica plants were made, thus totalling 4046 clonal plants. On account of the success achieved, it was possible to provide sufficient material to (1) increase the replication from 3 to 8 in the case of the randomised replicated layout with 20 arabica cultures, (2) to increase the replication from 5 to 9 in the case of 10 robusta cultures and (3) also to plant two other plots to compare the clonal progeny of both arabica and robusta cultures that were not included in the previous layout.

19. The following table gives details of cuttings planted during the year, the number rooted upto the end of the year and the number that died during the process of hardening:—

Treatment given to cuttings: Suckers were rung 15 to 20 days prior to their severance from the plants. These were later removed from the plants and immediately the cut ends were immersed in water. Cuttings were prepared from these and were treated with urine extract using the 'quick-dip' method prior to planting in propagation chambers in sand rooting medium provided with moss-cover.

TABLE X—Details of cuttings planted, and rooted

SELECTION		No. of suckers harvested	No. of cuttings planted	NUMBER OF ROOTED CUTTINGS			Percentage Existing	
				Trans—planted into beds up to end of June 52	Died during hardening process	Existing on 30-6-1952		
1		2	3	4	5	6	7	
<i>Arabica</i>								
B.A	1.	...	7	22	13	3	10	45.4
Series	2.	...	4	12	10	...	10	83.3
	3.	...	7	20	9	...	9	45.0
	4.	...	8	29	16	1	15	51.7
	5.	...	14	43	8	1	7	16.3
	6.	...	12	36	10	...	10	27.8
	7.	...	20	78	15	4	11	14.1
	8.	...	17	103	36	5	31	30.1
	9.	...	24	78	35	2	33	42.3
	0.	...	10	37	27	...	27	73.0
	1.	...	19	72	27	1	26	36.1
	2.	...	15	43	42	4	38	88.4
	13.	...	47	168	65	1	64	38.1
	14.	...	33	101	35	3	32	31.7
	15.	...	24	82	36	1	35	42.7
	16.	...	39	142	57	1	56	39.4
	17.	...	30	93	65	4	61	65.6
	18.	...	45	164	78	3	75	45.7
	19.	...	28	91	68	1	67	93.4
	20.	...	29	97	42	2	40	41.2
	21.	...	45	177	30	4	26	14.7
	22.	...	59	196	77	10	67	34.2
	23.	...	25	77	42	8	34	44.2
	25.	...	35	113	22	3	19	16.8
	26.	...	17	87	40	...	40	46.0
	27.	...	9	40	33	4	29	72.5
	28.	...	8	38	22	3	19	50.0
	29.	...	18	23	12	...	12	52.2
	30.	...	25	90	61	1	60	66.7
	31.	...	18	55	18	7	11	20.0
	32.	...	17	70	25	10	15	21.4
	33.	...	2	11	8	1	7	63.6
	34.	...	16	62	49	10	39	62.9

	1	2	3	4	5	6	7
35.	...	4	27	24	2	22	81.5
36.	...	5	34	23	4	19	55.9
<i>Robusta</i>							
B.R.	1.	...	3	12	8	2	50.0
Series	2.	...	6	16	13	...	81.3
	3.	...	2	10	...	8	80.0
	4.	...	8	30	27	1	86.7
	5.	...	24	68	17	...	25.0
	6.	...	16	39	25	4	53.9
	7.	...	3	5	4	1	60.0
	8.	...	4	15	14	1	85.7
	9.	...	5	15	15	3	80.0
	10.	...	24	67	48	6	62.7
	11.	...	7	18	13	...	86.7
	12.	...	2	6	6	...	100.0
	13.	...	3	8	7	...	75.0
	14.	...	19	53	36	2	64.2
	15.	...	9	24	16	4	50.0
	16.	...	3	11	10	2	72.7
	17.	...	15	56	51	1	89.3
<i>Kents Arabica</i>							
450-2	...	10	42	28	1	27	67.3
450-4	...	11	44	25	...	25	56.8
450-6	...	9	28	28	3	25	89.3
450-10	...	13	48	35	...	35	72.9
450-12	...	15	56	35	1	34	60.7
450-14	...	10	32	28	3	25	78.1
450-15	...	11	38	17	...	17	44.7
450-16	...	10	31	22	...	22	71.0
450-22	...	19	72	32	1	31	43.1
450-23	...	11	43	26	1	25	58.1
450-24	...	10	33	27	2	25	75.8
450-25	...	10	64	39	3	36	56.3
450-26	...	12	47	32	7	25	53.2
450-30	...	8	33	26	1	25	75.8
450-31	...	17	57	42	...	42	73.7
450-33	...	13	38	27	1	26	68.4
450-34	...	9	30	29	4	25	83.3
450-35	...	13	39	26	1	25	64.1
450-36	...	19	68	51	1	50	73.5
450-37	...	6	26	25	...	25	96.2
450-39	...	12	45	29	1	28	62.2
450-40	...	8	34	28	...	28	82.3
450-41	...	17	65	45	...	45	69.2
450-45	...	14	49	40	2	38	77.6
450-47	...	7	31	26	1	25	80.6
450-51	...	22	65	56	...	56	86.2
450-59	...	16	45	14	...	14	31.1
450-60	...	7	28	27	2	25	89.3
450-62	...	10	45	25	...	25	55.6
450-63	...	11	38	25	...	25	65.8
450-65	...	12	37	25	...	25	67.6
450-66	...	10	38	17	1	16	42.1
450-69	...	8	30	10	2	8	26.7
450-70	...	9	32	4	...	4	12.5
450-71	...	9	30	9	2	7	23.3
450-73	...	16	49	28	3	25	51.0
450-75	...	13	41	26	1	25	61.0
450-86	...	12	36	26	1	25	69.5
450-88	...	13	42	26	1	25	59.5
<i>Arabica (rest)</i>							
S. 26	...	...	305	251	13	238	78.0
S. 31	...	...	1344	973	99	874	65.0
645	...	...	1024	550	21	529	51.7

Summary

SELECTION	No. of cuttings planted	NUMBER OF ROOTED CUTTINGS				
		trans-planted	per-centage	Dead during hardening	Existing on 30-6-52	Percentage
<i>Arabica</i>			%			
<i>Cultures</i> ...	2611	1180	45.2	104	1076	41.2
<i>Robusta</i>						
<i>Cultures</i> ...	453	318	70.2	28	290	64.0
<i>Kents</i> ...	1549	1086	65.9	47	1039	63.0
<i>Arabica</i> (rest) ...	2673	1774	66.4	133	1641	61.4
Total ...	7386	4358	59.0	312	4046	54.8

It will be observed from the table that the total number of cuttings rooted is 59 per cent out of which during the process of hardening 4.2 per cent died thus giving a net result of 54.8 per cent. While the total percentage of rooted cuttings from the arabica cultures varied from 14.1 to 93.4 (in spite of precuring of suckers before removal from the plants), the percentage of rooted cuttings from the robusta cultures has varied from 25 to 100. There is great variation in the percentage of rooted cuttings from culture to culture. It is observed that the variation is very great in the cultures in B.A. series (arabica). Comparatively the rooting of cuttings of cultures in the B. R. series (robusta) is more successful.

20. Clonal and seedling progeny of the following families were given over to the estate section for planting vacancies in non-experimental plots.

Selections	No. of seedlings.	No. of clonal plants.
<i>Arabica</i>		
S.288	772	—
S.795	1,415	75
S.333	50	—
S.645	755	137
S.26 × Kent	375	—
S.531 × Kent	2,342	—
Total ...	5,709	212
<i>Robusta</i>		
S.274	250	—
Grand total	5,959	212

21. At Chethalli, the propagation of clonal material for manurial experiments from 86 arabica and 50 robusta trees were continued. The present position is:

	<i>Arabica.</i>	<i>Robusta.</i>	<i>Devamachi hybrids.</i>
Number of rooted cuttings in the field	109	461	—
Number of rooted cuttings in the nursery beds and being hardened.	1,626	1,920	90

Even though according to last year's experience there were considerable losses during the hardening process, the losses during the last hot weather were very little.

B. CHEMISTRY

22. The Permanent Manurial experiments laid out in 1939 and the Fundamental manurial experiments laid out in 1950 at the Coffee Research Station, Balehonnur were continued. The Co-operative manurial experiments in Mysore area (at Santaveri and Watekhan) as well as the Bulky v. Concentrated manurial experiment at Netraconda (Mysore) were discontinued as these did not yield any results. However the two co-operative manurial experiments in Coorg area were continued for another year. A new manurial experiment was started during the year at Balehonnur under natural shade with a view to study the effect of 40, 60, 80, and 100 lb. of nitrogen per acre on yield of coffee.

The results are furnished below.

Permanent Manurial Experiments at Balehonnur (Mysore)

Annual rate of manuring :

N.	(From 1941 to 1949)	= 20 lb. per acre
N.	(From 1950)	= 40 lb. —do—
P ₂ O ₅		= 30 lb. —do—
K ₂ O		= 40 lb. —do—

Area of experimental block: 76 cents.

Layout: Latin square.

No of plants per sub-plot: 5 × 8.

Spacing: 5 ft. × 5 ft.

Variety: Kent's arabica.

Guard rows: One row all round the block.

TABLE XI—Yield record of Permanent Manurials

YEAR	Average yield of ripe cherry in lb. and clean coffee in cwt. calculated per acre.					Std. error express- ed as % gen. mean	Critical differ- ence P=0.05	Signifi- cant or Not	CON- CLUSIONS	
	T R E A T M E N T S									
	N A	N+P B	N+K C	+K D	Con- trol E					
1941 Ripe cherry	...	791	663	918	918	553	21.8	513	No	<u>C, D, A, B, E</u>
1942 "	...	1250	1207	1335	1360	740	11.8	436	Yes	<u>D, C, A, B, E</u>
1943 "	...	60	89	113	85	43	17.9	16	Yes	<u>C, B, D, A, E</u>
1944 "	...	255	213	306	264	204	19.0	147	No	<u>C, D, A, B, E</u>
1945 "	...	1155	1132	1519	1744	736	26.9	1040	No	<u>D, C, A, B, E</u>
1946 "	...	400	531	332	595	510	27.4	411	No	<u>D, B, E, A, C</u>
1947 "	...	468	697	714	697	587	4.9	379	No	<u>C, D, B, E, A</u>
1948 "	...	281	306	306	255	272	17.1	498	No	<u>B, C, A, E, D</u>
1949 "	...	489	655	483	761	674	8.2	107	Yes	<u>D, E, B, A, C</u>
1949 Clean coffee	...	0.625	0.83	0.688	0.83	0.964	1.2	0.294	Yes	<u>E, D, B, C, A</u>
1950 Ripe cherry	...	1776	1836	1700	1734	1598	9.4	455	No	<u>B, A, D, C, E</u>
1950 Clean coffee	...	2.59	2.60	2.46	2.52	2.23	9.63	0.737	No	<u>B, A, D, C, E</u>
1951 Ripe cherry	...	562	396	540	273	229	22.02	270	Yes	<u>A, C, B, D, E</u>
1951 Clean coffee	...	0.891	0.602	0.821	0.396	0.330	23.65	0.442	Yes	<u>A, C, B, D, E</u>
1952 Ripe cherry	...	2371	2312	2286	2329	1530	10.51	701	Yes	<u>A, D, B, C, E</u>
1952 Clean coffee	...	3.53	3.38	3.31	3.36	2.18	10.59	1.02	Yes	<u>A, B, D, C, E</u>
Average for 12 years										
Ripe cherry		818	829	917	929	645	9.08	232	Yes	<u>D, C, B, A, E</u>

Considering the yields of ripe cherry and clean coffee for 1951 and 1952, it is seen that in 1951, treatments A and C (Nitrogen and Nitrogen + Potash) are significantly superior to E (no manure). In 1952, however, all the manurial treatments are superior to *no manure*. It is worth noting however that in both years treatment A (Nitrogen only) is significantly superior to control. Doubling of nitrogen dose since 1950 has evidently produced this effect. In the analysis of the average yield of 12 years, the results follow the same trend as for the average for 11 years.

23. Analysis of the soil of sub-plots of the above experiments have given the following averages in milligrams per 100 grams of oven-dry soil:—

Sub-plot	0—9"			9—18"		
	N	P	K	N	P	K
1950						
Control	... 262	119	129	206	90.7	81.8
N+P+K	... 251	98	111	203	114	142
N + K	... 269	100	110	209	49.6	135
N + P	... 244	99.5	216	228	97.4	90.3
N only	... 260	67.6	130	212	70.9	247
1951						
Control	... 286	86.1	293	203	30.3	382
N+P+K	... 251	188	379	207	176	388
N + K	... 235	98.1	329	205	131	276
N + P	... 254	108	294	205	113	276
N only	... 235	90.3	321	198.4	79.8	348

It will be observed that the values for nitrogen are more or less constant for both the years in both the 0—9" and 9—18" levels. Quite a large reserve of P_2O_5 and K O have been built up in all the plots by the continued addition of 10,000 lb. of leaf mulch per acre for nearly 10 years so that the differences caused by the application or omission of either of the two plant nutrients do not become felt yet.

24. **Lights in relation to manurial treatments:** During the harvest of the manurial plots at Balehonnur the float contents of the produce were determined. The results obtained for the last 4 years are tabulated below.

TABLE XII—Lights in relation to manurial treatments

YEAR	TREATMENTS					Standard error % gen. mean	Critical differ- ence P=0.05	Signifi- cant or not	Con- clusion
	N	N+P	N+K	N+P +K	Con- trol				
	A	B	C	D	E				

1949									
By weight ...	5.4	3.8	8.0	9.8	5.4	32.56	7.92	No	<u>D, C, A, E, B</u>
„ volume ...	3.62	2.91	5.77	6.51	7.02	38.24	6.06	No	<u>E, D, C, A, B</u>
1950									
„ weight ...	7.31	8.7	7.29	7.9	8.83	9.11	2.25	No	<u>E, B, D, A, C</u>
„ volume ...	8.35	9.42	7.98	9.29	9.19	7.71	2.15	No	<u>D, E, B, A, C</u>
1951									
„ weight ...	6.25	6.77	4.52	6.44	5.02	20.37	6.06	No	<u>C, E, A, D, B</u>
„ volume ...	3.91	3.58	3.02	4.39	3.05	20.07	2.22	No	<u>C, E, B, A, D</u>
1952									
„ weight ...	5.25	5.88	5.7	6.21	7.67	9.837	1.888	Yes	<u>E, D, B, C, A</u>
„ volume ...	6.90	7.63	7.35	7.85	8.58	5.475	1.293	Yes	<u>E, D, B, C, A</u>

It is seen that on the whole there was no significant difference between the various treatments, but for the first time in 4 years, treatment E (control) had shown significantly higher percentage of *floats* than A (nitrogen only). It is unsafe to draw any conclusions from this one exception.

Co-operative manurial experiments on private estates

SERIES I

Annual rate of manuring

N. (1940 to 1948)	=	20 lb. per acre.
N. (From 1949 Nov.)	=	40 lb. do
P ₂ O	=	30 lb. do
K ₂ O	=	40 lb. do

Area of experimental plot : 1.43 acres.

Layout = Latin square.

Variety : Kent's arabica

5 × 5

Shade : Natural shade

Spacing : 6' × 6'

No of plants per sub-plot : Gross — 10 × 7 ; Nett — 8 × 5.

Results of Co-operative manurial experiments
TABLE XIII—Experiment I. Kirgandur estate (Coorg)

YEAR		Average yield of ripe cherry in lb. and clean coffee in cwt. calculated per acre					Sig. or not	Critical dif. P= 0.05	Con- clusions	
		TREATMENTS								
		N+P								
		N	N+P	N+K	+K	Cont.				
A	B	C	D	E						
1940	R. Cherry	...	1362	1320	1242	1062	1362	No	416	<u>E, A, B, C, D</u>
	C. coffee	...	2.03	1.96	1.85	1.58	2.03		0.62	
1941	R. Cherry	...	2562	2106	2286	2796	2124	No	1262	<u>D, A, C, E, B</u>
	C. coffee	...	3.81	1.52	1.99	4.16	3.16		1.88	
1942	R. Cherry	...	1088	1020	1338	1008	846	Yes	430	<u>C, A, B, D, E</u>
	C. coffee	...	1.62	1.52	1.99	1.50	1.26		0.64	
1943	R. Cherry	...	1368	1818	1566	1608	1542	No	528	<u>B, D, C, E, A</u>
	C. coffee	...	2.04	2.71	2.33	2.39	2.29		0.79	
1944	R. Cherry	...	5076	5724	5712	4056	4860	No	1286	<u>B, C, A, E, D</u>
	C. coffee	...	7.55	8.52	8.50	6.04	7.23		1.91	
1945	R. Cherry	...	4914	3948	3900	4188	3906	Yes	992	<u>A, D, B, E, C</u>
	C. coffee	...	7.31	5.88	5.80	6.23	5.81		1.48	
1946	R. Cherry	...	3595	3912	4189	3269	3707	No	852	<u>C, B, E, A, D</u>
	C. coffee	...	5.35	5.82	6.23	4.86	5.52		1.27	
1947	R. Cherry	...	3408	3132	4080	4672	3366	No	912	<u>D, C, A, E, B</u>
	C. coffee	...	5.07	4.66	6.07	6.95	5.01		1.36	
1948	R. Cherry	...	366	606	330	276	300	Yes	242	<u>B, A, C, E, D</u>
	C. coffee	...	0.54	0.90	0.49	0.41	0.45		0.36	
1949	R. Cherry	...	4464	4650	3862	4386	4260	No	922	<u>B, A, D, E, C</u>
	C. coffee	...	6.64	6.92	5.75	6.53	6.34		1.37	
1950	R. Cherry	...	3306	3292	3233	3455	3364	No	1395	<u>D, E, A, B, C</u>
	C. coffee	...	4.92	4.90	4.81	5.14	5.01		2.08	
1951	R. Cherry	...	7512	7296	6372	5028	5454	No	3713	<u>A, B, C, E, D</u>
	C. coffee	...	11.18	10.86	9.48	7.48	8.12		5.53	
1952	R. Cherry	...	2976	3300	2940	3240	3372	No	1268	<u>E, B, D, A, C</u>
	C. coffee	...	4.43	4.91	4.38	4.82	5.02		1.89	
Average for 13 years										
	R. Cherry	...	3231	3240	3158	3004	2958			
	C. coffee	...	4.81	4.82	4.70	4.47	4.40			

There is no response to manuring in 10 out of 13 years. Taking the average yields for 13 years, the control continues to be lowest numerically, but does not fall within the level of significance.

TABLE XIV—Experiment 2. Gargandur Estate (Coorg)

YEAR		Average yield of ripe cherry in lb. and clean coffee in cwt. calculated per acre					Sig. or not	Critical dif. P= 0.05	Con- clusion	
		TREATMENTS								
		N A	N+P B	N+K C	N+P +K D	Cont. E				
1940	R. Cherry	...	979	937	1047	1211	709	Yes	407	<u>D, C, A, B, E</u>
	C. coffee	...	1.46	1.39	1.56	1.80	1.06		0.61	
1941	R. Cherry	...	1924	1802	2103	2572	2700	No	929	<u>E, D, C, A, B</u>
	C. coffee	...	2.86	2.68	3.13	3.83	4.02		1.38	
1942	R. Cherry	...	2132	1792	2338	2669	1707	No	1086	<u>D, A, C, B, E</u>
	C. coffee	...	3.17	2.67	3.48	3.97	2.54		1.62	
1943	R. Cherry	...	1291	401	564	378	899	No	735	<u>A, E, C, B, D</u>
	C. coffee	...	1.92	0.60	0.84	0.56	1.34		1.09	
1944	R. Cherry	...	2814	3492	4200	4248	3294	No	1092	<u>D, C, B, E, A</u>
	C. coffee	...	4.19	5.20	6.25	6.32	4.90		1.63	
1945	R. Cherry	...	2148	1494	1956	1428	2070	No	920	<u>A, E, C, B, D</u>
	C. coffee	...	3.20	2.22	2.91	2.13	3.08		1.37	
1946	R. Cherry	...	2279	2345	3279	2571	2474	No	1010	<u>C, D, E, B, A</u>
	C. coffee	...	3.39	3.49	4.88	3.83	3.68		1.50	
1947	R. Cherry	...	2742	2580	3120	2724	2970	No	468	<u>C, E, A, D, B</u>
	C. coffee	...	4.08	3.84	4.64	4.05	4.42		0.70	
1948	R. Cherry	...	126	90	78	54	72	No	83	<u>A, B, C, E, D</u>
	C. coffee	...	0.19	0.13	0.12	0.08	0.11		0.12	
1949	R. Cherry	...	3174	3204	3112	3264	3252	No	608	<u>D, E, B, A, C</u>
	C. coffee	...	4.72	4.77	4.63	4.86	4.84		0.90	
1950	R. Cherry	...	1632	2082	1777	1962	2073	No	479	<u>B, E, D, C, A</u>
	C. coffee	...	2.43	3.10	2.64	2.92	3.08		0.71	
1951	R. Cherry	...	4902	4524	4638	5196	5100	No	1362	<u>D, E, A, C, B</u>
	C. coffee	...	7.29	6.73	6.90	7.73	7.59		2.03	
1952	R. Cherry	...	4188	4896	3726	5916	4980	No	1805	<u>D, E, B, A, C</u>
	C. coffee	...	6.23	7.29	5.54	8.80	7.41		2.69	
Average for 13 years :										
	R. Cherry	...	2336	2280	2457	2630	2485			
	C. coffee	...	3.48	3.39	3.66	3.91	3.70			

In this experiment also there is no response to manure except in 1940 when treatment D (N+P+K) was superior to E (no manure). The 13-year averages do not also show any significant difference between treatments.

SERIES II

Bulky v. concentrated manurial experiments

Annual rate of manuring :—

- Treatment* :—A. No manure (control).
 B. 5 tons cattle manure per acre.
 C. 5 tons cattle manure + 30 lb. N in the form of groundnut cake and 40 lb. P_2O_5 as bonemeal.
 D. 5 tons cattle manure + 30 lb. N in the form of groundnut cake + 40 lb. P_2O_5 as steamed bonemeal + 50 lb. K_2O as muriate of potash.
 E. 30 lb. N as groundnut cake + 40 lb. P_2O_5 as steamed bonemeal + 50 lb. K_2O as muriate of potash.

Area of experimental block = 1.28 acres.

Variety = Kent's arabica.

Shade = Natural shade.

Layout = Latin square 5 × 5.

Spacing = 6' × 6'.

No. of plants per sub-plot : } After 1945, alternate plants were removed leaving only 32 plants in the gross.

Gross = 8 × 8.

Nett = 6 × 6.

Locality : Boothanhadloo (Coorg)

TABLE XV.—Results of Bulky v. Concentrated manurials

YEAR	Average yield of (a) ripe cherry in lb. and (b) clean coffee in cwt. calculated per acre.					Std. error express- ed as % of gen. mean	Critical differ- ence	Signifi- cant or Not	Con- clusions	
	TREATMENTS									
	A	B	C	D	E					
1943	(a) ...	1881	1782	1584	1584	1485	365	1124	No	<u>A, B, C, D, E</u>
	(b) ...	2.80	2.65	2.36	2.36	2.21		1.67		
1944	(a) ...	1584	1221	1518	1584	1881	315	970	No	<u>E, A, D, C, B</u>
	(b) ...	2.36	1.82	2.26	2.36	2.80		1.44		
1945	(a) ...	4138	4112	3663	3854	3346	316	974	No	<u>A, B, D, C, E</u>
	(b) ...	5.16	6.12	5.45	5.74	4.98		1.45		
1946	(a) ...	318	251	86	165	185	75	231	Yes	<u>A, B, E, D, C</u>
	(b) ...	0.47	0.37	0.13	0.25	0.28		0.34		
1947	(a) ...	1749	1439	1432	1228	1016	192	593	No	<u>A, B, C, D, E</u>
	(b) ...	2.60	2.14	2.14	1.98	1.51		0.88		
1948	(a) ...	2970	3399	2574	2831	2780	291	898	No	<u>B, A, D, E, C</u>
	(b) ...	4.42	5.06	3.83	4.21	4.14		1.34		
1950	(a) ...	2733	2767	2633	3100	2533	10.44		No	<u>D, B, A, C, E</u>
	(b) ...	4.07	4.12	3.92	4.76	3.77				
1952	(a) ...	1652	852	1325	1325	1032	22.84	868	No	<u>A, C, D, E, B</u>
	(b) ...	2.46	1.27	1.97	1.97	1.54		1.29		
Mean	(a) ...	2128	1978	1852	1959	1783				
	(b) ...	3.17	2.94	2.76	2.92	2.65				

There is no response to manuring in all the treatments.

25. **Catalyzation of nutrients.** The two experiments—one at each Research Station—laid out in 1948 in co-operation with the Biochemistry Department of the Indian Institute of Science, to test the effect of certain catalysts on the availability of manures applied, were continued. The first application of manures was done in June 1948. The results are furnished below :

EXPERIMENT I

Locality : L-1 Block of the Coffee Research Station, Balehonnur.

Annual rate of manuring : N = 20 lb. per acre till 1949 and 40 lb. per acre thereafter in the form of g.n. cake : Am_2SO_4 : : 3 : 1.

P_2O_5 = 30 lb. per acre as superphosphate or steamed bonemeal.

K_2O = 40 lb. per acre as cherry husk ash.

In addition, certain catalysts (certain chemicals in very fine state of sub-division) are added to the sub-plots according to treatment.

Area of experiment plot: = 1.43 acres. *Layout*: Latin square 5 × 5.
Variety: Kent's arabica. *No. of plants per sub-plot*.
Shade: Natural shade. *Gross*: 10 × 7.

Shade : Natural shade.

Gross : 10×7 .

Nett : 8×5 .

Spacing: 6 ft. $\times$ 6 ft.

Treatments :

- A. Proprietary Product A.

- B. Proprietary Product B.

- C. Ferrous sulphate.

- D.* Potassium permanganate.

- E.* Control (No catalyst added).

General manurial mixture containing 40 lb. N., 30 lb. P_2O_5 and 40 lb. K_2O per acre (1200 plants) to all the sub-plots.

TABLE XVI—Results of catalyzed manures experiment

YEAR	Average yield of ripe cherry in lb. and clean coffee in cwt. calculated per acre.					Std. error ex- pressed as % gen. mean	Critical differ- ence. P=0.05	Sig. or not	Con- clusions
	TREATMENTS								
	A	B	C	D	E				
1949 (a)* ...	498	504	456	480	480	49.1	74	No	<u>B,A,D,E,C</u>
(b) ...	0.813	0.893	0.508	0.732	0.758	18.05	0.41	No	<u>B,A,E,D,C</u>
1950 (a) ...	672	624	498	798	558	19.21	374	No	<u>D,A,B,E,C</u>
(b) ...	0.929	0.804	0.696	1.000	0.732	20.93	0.545	No	<u>D,A,B,E,C</u>
1951 (a) ...	744	780	678	816	816	19.14	753	No	<u>D,E,B,A,C</u>
(b) ...	1.112	1.112	0.952	1.113	1.112	18.83	0.629	No	<u>D,A,B,E,C</u>
1952 (a) ...	3872	3600	3024	3560	3682	9.92	960.9	No	<u>A,E,B,D,C</u>
(b) ...	6.061	5.118	4.336	5.196	5.158	10.07	1.409	Yes	<u>A,D,E,B,C</u>
Average for 4 years									
(a) ...	1367	1296	1031	1332	1269	10.1	392	No	<u>A,D,B,E,C</u>

The treatments have not been significant. Ferrous sulphate appears to depress the yields. Unlike as in previous three years, treatment A (Proprietary Product A) is numerically superior to other treatments.

* (a) Ripe cherry. (b) Clean coffee.

EXPERIMENT II

Locality: Coffee Research sub-station, Chethalli.

Layout: 5×5 latin square.

Varients: 5 as noted below.

No of plants per sub-plot: Gross 10×7 . Variety: Arabica (Coorg)

Nett 8 × 5 plants.

planted about 20 yrs back.

Shade: Natural shade.

Treatments:

A.	28 lb. Ferrous sulphate.	} per acre+General manurial mixture.
B.	20 lb. Potassium permanganate.	
C.	40 lb. Catalyst product.	
D.	80 lb. Catalyst product.	
E.	Control (No catalyst).	

**TABLE XVII—Results of catalyzed manures experiment—
Chethalli (Coorg)**

YEAR	Average yield of ripe cherry in lb. and clean coffee in cwt. calculated per acre.					Std. error % gen. mean	Critical differ- ence in lb. acre	Signifi- cant or not	Con- clusion	
	TREATMENTS									
	A	B	C	D	E					
1950	(a)* ...	1685	1330	1436	744	1538	29.50	1231	No	<u>A,E,C,B,D</u>
	(b) ...	3.00	2.38	2.56	1.33	2.75	29.50		No	<u>A,E,C,B,D</u>
1951	(a) ...	3012	2424	2844	1986	2658	9.74	775	No	<u>A,C,E,B,D</u>
	(b) ...	4.48	3.61	4.23	2.96	3.96	11.25	1.15	No	<u>A,C,E,B,D</u>
1952	(a) ...	540	804	594	372	546	20.92	367	No	<u>B,C,E,A,D</u>
	(b) ...	0.80	1.20	0.88	0.55	0.81		0.55		

* (a) Ripe cherry. (b) Clean coffee.

The stand of coffee trees was very varying. The number of potential bearing plants were counted in each plot and the regression of yield on plant number was worked out. This value was significant. However when the yields were calculated for equalised plant number the differences among the treatments were not significant.

26. The float contents of the above experiment at the Coffee Research Station, Balehonnur were determined both by weight and by volume. The results of four years are furnished below.

TABLE XVIII—Lights in relation to catalysed manures

YEAR	TREATMENTS					Standard error	Crit. diff.	Sig. or not	Conclusion
	A	B	C	D	E				
1949									
By weight ...	12.21	10.71	11.61	10.71	10.56	9.63	3.31	No	<u>A,C,B,D,E</u>
„ volume ...	10.36	7.95	9.15	9.81	11.13	6.258	1.874	Yes	<u>E,A,D,C,B</u>
1950									
„ weight ...	8.40	8.00	9.28	5.86	7.73	7.35	1.76	Yes	<u>C,A,B,E,D</u>
„ volume ...	9.37	8.9	10.48	6.88	9.07	9.64	2.65	Yes	<u>C,A,B,E,D</u>
1951									
„ weight ...	6.15	5.44	4.62	5.83	6.29	12.76	2.23	No	<u>E,A,D,B,C</u>
„ volume ...	5.63	5.28	4.49	5.2	5.91	10.22	1.669	No	<u>E,A,B,D,C</u>
1952									
„ weight ...	6.22	7.07	7.25	7.44	8.55	7.313	1.646	Yes	<u>E,D,C,B,A</u>
„ volume ...	7.30	8.08	8.51	7.90	8.74	2.375	0.5936	Yes	<u>E,C,B,D,A</u>

Here again the results are so inconsistent that it is impossible to ascribe higher float content to any of the catalytic agents.

Fundamental manurial experiments at Balehonnur

27. In accordance with the recommendations of the Expert Committee, a fundamental experiment on manuring was started at Balehonnur using the 36 cisterns which were built earlier to study the effect of varying pH on the growth of coffee. Clonal material from S-31 was planted in 1949 and manurial applications made in 1950.

EXPERIMENT

Locality = Coffee Research Station, Balehonnur.

Area of experimental plot 3 cents.

Variety = Arabica (Clones from S.31)

Plot = Single plant.

Layout = Latin square 6 × 6.

Shade = Artificial (coir netting).

Treatments = Six.

Size of each cistern = 6' × 6' = 36 sq. ft.

Replications = Six

Note.—Masonry walls separate the plants from one another.

Treatments.

Manurial scheme Pounds per acre.

	N	P ₂ O ₅	K ₂ O
A.	20	30	40
B.	30	30	40
C.	45	30	40
D.	30	45	40
E.	30	45	60
F.	45	67.5	90

Nitrogen is given half as groundnut oil-cake and half as ammonium sulphate. Half the nitrogen is applied pre-monsoon and half post-monsoon. Phosphoric and potash are given pre-monsoon mixed with the

nitrogenous manure and applied in the form of a ribbon all round the plant. Phosphoric acid is given in the form of steamed bonemeal and potash in the form of muriate of potash.

28. Periodical observations on the growth of the plants is being maintained. Soil samples are being taken periodically, once before the application of manures in May and again after the monsoon before the second application of nitrogenous manures in post-monsoon period, to assess the proportion of plant foods used by coffee and that lost by leaching. The following table gives the average N.P.K. figures of the soil samples under each treatment, during the post-monsoon period of 1950.

TABLE XIX.—Average N.P.K. content of soil in cisterns in milligrams per 100 grams of oven-dry soil

			T R E A T M E N T					
			A	B	C	D	E	F
0 — 9"	...	N.	209	184	177	185	155	188
		K.	253	254	255	245	194	246
		P.	89	88	90	87	76	89
9 — 18"	...	N.	229	242	240	238	205	215
		K.	183	212	222	155	191	168
		P.	81	79	93	87	81	71

Nitrogen in the 9-18" layer is higher than in the 0-9" layer in all the treatments which indicates percolation of nitrogen into that layer. On the other hand the potash content is slightly more in the 0-9" layer than in the 9-18" layer.

Manurial experiment on robusta

29. The experiment was started last year to find out the effect of applications of complete fertiliser with two variants for nitrogen as noted in the table. The plants are over 20 years old. During the year nitrogen was applied as ammonium sulphate only. Half the dose of nitrogen was applied pre-blossom and the other half post-monsoon. Besides the above, three of the six replications were given moderate pruning to study the inter-action between manure and pruning on the yields. The results are furnished below—

Locality: Balehonnur.

Year: 1951-52

Variety: Robusta

Layout: Randomized blocks
replicated 6 times.

Spacing: 8' × 8'

No of plants per sub-plot Gross 8 × 4 (32 plants)
Blocks II, IV & VI pruned.

Nett 6 × 2 (12 plants)

TABLE XX—Results of manurial experiment on robusta

N o.	Symbol	T R E A T M E N T			Yield of ripe cherry in lb. per acre	Yield of clean coffee in cwt. per acre	% float by weight
		lb.	per	acre			
		N	P	K			
1.	A.	40	30	40	1739	3.02	1.41
2.	B.	80	30	40	1804	3.27	2.66
3.	C.	No manure (control)			1331	2.44	1.56
		Mean.			1624.7	2.91	1.87
		Sig. or not				No.	Yes.
		Crit. diff.				1.7	0.30
		S.E.M. %				10.27	4.90
		Conclusions				B, A, C	B, C, A

Observations noted during the year indicate no difference between treated and untreated plots either in spike production or in the time of flowering. The crop in all the treatments were found to ripen about the same period. Though the manured plots show highest yields, this misses significance. The treatment with 80 lb. nitrogen gave significant increase of 'lights'.

30. **Erythrine lithosperma (Dadap) pruning experiment:** The experiment laid out in 1950-51 on the suggestion of Mr. Ivor Bull to study the release of nitrogen from the root nodules of *E. lithos perma* plants consequent to lopping of branches was continued.)

The soil samples from both 0-9" and 9-18" layers from around the experimental plants and root samples containing nodules were collected before applying the treatments. The results are furnished below.—

Locality: 17-acre plot on the Coffee Research Station, Balghonnur.

Treatments: 3 A. Control (no looping)
B. Complete lopping of all branches
C. Lopping of all branches except three leaders.

Replications: 6

Plot: Single tree.

Seasons 2 (June and October).

Samples taken: i. Before application of treatment—Once.
ii. After " " —Four times at fortnightly intervals.

TABLE XXI—Percentage of average nitrogen content of root nodules (oven-dry) samples

SAMPLE	TREATMENTS			S.E.M. %	Critical Difference P=0.05	Signifi- cant or not	Conclusion
	A	B	C				
FIRST SEASON							
First	... 16.350	34.214	15.564	31.35	21.55	No.	<u>B, A, C</u>
Second	... 6.138	7.056	5.819	19.44	3.882	No.	<u>B, A, C</u>
Third	... 3.243	3.499	2.945	7.015	0.7166	No.	<u>B, A, C</u>
Fourth	... 2.975	3.097	2.848	7.977	0.7463	No.	<u>B, A, C</u>
Fifth	... 3.409	3.332	3.801	9.588	1.059	No.	<u>C, A, B</u>
SECOND SEASON							
First	... 4.232	4.307	4.393	4.795	0.6515	No.	<u>C, B, A</u>
Second	... 3.573	4.763	3.931	5.351	0.6893	Yes.	<u>B, C, A</u>
Third	... 4.007	4.347	4.290	10.251	1.361	No.	<u>B, C, A</u>
Fourth	... 4.660	4.475	3.958	8.145	1.120	No.	<u>A, B, C</u>
Fifth	... 4.380	3.911	3.795	12.255	1.556	No.	<u>A, B, C</u>

In the first season the quantity of nitrogen contained in the nodules before the treatments were applied, was quite high. A general reduction in the nitrogen content followed in all the treatments and there has been no significant difference between the treatments in any of the observations. In the second season there has been a significant difference between the treatments in the second observation. However, in no other observation can a significant difference be observed. In the second season (post-monsoon period) the nitrogen content of the nodules is more constant than in the first season.

**TABLE XXII—Percentage of average nitrogen contents in roots
(oven-dry)**

SAMPLE	TREATMENTS			S. E. M. %	Critical difference P=0.05	Signifi- cant or not	Conclusion
	A	B	C				
FIRST SEASON							
First	... 5.414	5.489	6.823	23.0	4.823	No.	<u>C, B, A</u>
Second	... 2.977	2.931	2.414	11.85	0.4648	Yes.	<u>A, B, C</u>
Third	... 2.753	2.416	2.455	15.84	1.269	No.	<u>A, C, B</u>
Fourth	... 2.823	2.404	2.340	9.815	0.7625	No.	<u>A, B, C</u>
Fifth	... 2.360	2.421	2.408	5.359	0.4436	No.	<u>B, C, A</u>
SECOND SEASON							
First *	... 3.045	2.905	2.928	7.305	0.6803	No.	<u>A, C, B</u>
Second	... 2.291	2.373	2.487	6.108	0.4587	No.	<u>C, B, A</u>
Third	... 2.408	2.142	2.282	8.328	0.5974	No.	<u>A, C, B</u>
Fourth	... 2.826	2.373	2.411	6.244	0.4990	No.	<u>A, C, B</u>
Fifth	... 2.496	2.536	2.572	6.210	0.4923	No.	<u>B, C, A</u>

As with the root nodules, the nitrogen content in the roots at the beginning of the experiments was very much higher than that contained in them after treatment. During the interval between the two seasons, there has been once again a slight accumulation of nitrogen in roots. The results of the second samples in the first season have been significant, treatments A (Control) and B (complete topping) being significantly superior to the other. Out of 10 samples, in six cases, treatment A has been numerically superior to all others.

TABLE XXIII—Percentage of average nitrogen content in soil samples around the plants (oven-dry)

SAMPLE	TREATMENTS			S.E.M. %	Critical difference	Signifi- cant or not	Conclusion
	A	B	C				
FIRST SEASON							
0 — 9"							
First	...	0.226	0.192	0.244	12.13	0.0845	No. $\overline{C, A, B}$
Second	...	0.187	0.191	0.194	8.0	0.0481	No. $\overline{A, C, B}$
Third	...	0.209	0.182	0.205	8.68	0.0544	No. $\overline{A, C, B}$
Fourth	...	0.172	0.177	0.180	7.33	0.0406	No. $\overline{C, B, A}$
Fifth	...	0.190	0.180	0.186	9.29	0.0542	No. $\overline{A, C, B}$
9 — 18'							
First	...	0.228	0.190	0.201	8.68	0.0564	No. $\overline{A, C, B}$
Second	...	0.171	0.156	0.157	7.0	0.0358	No. $\overline{A, C, B}$
Third	...	0.193	0.168	0.176	7.13	0.0402	No. $\overline{A, C, B}$
Fourth	...	0.202	0.173	0.178	6.27	0.0364	No. $\overline{A, C, B}$
Fifth	...	0.183	0.168	0.163	11.66	0.0628	No. $\overline{A, B, C}$
SECOND SEASON							
0 — 9"							
First	...	0.201	0.220	0.213	7.494	0.0498	No. $\overline{B, C, A}$
Second	...	0.207	0.177	0.196	10.51	0.0446	No. $\overline{A, C, B}$
Third	...	0.173	0.184	0.184	6.216	0.0353	No. $\overline{C, B, A}$
Fourth	...	0.188	0.171	0.155	14.85	0.08	No. $\overline{A, B, C}$
Fifth	...	0.193	0.197	0.187	5.128	0.031	No. $\overline{B, C, A}$
9 — 18"							
First	...	0.176	0.185	0.180	7.053	0.04	No. $\overline{B, C, A}$
Second	...	0.193	0.167	0.178	6.461	0.0365	No. $\overline{A, C, B}$
Third	...	0.155	0.147	0.144	8.678	0.0406	No. $\overline{A, B, C}$
Fourth	...	0.133	0.121	0.158	11.01	0.0476	No. $\overline{C, A, B}$
Fifth	...	0.160	0.183	0.178	9.376	0.0512	No. $\overline{B, C, A}$

In both the seasons there is a gradual reduction in nitrogen content after the first observation. The nitrogen content increased by the time the fifth observation was taken.

From a study of the data obtained above, it appears as though the nitrogen in the root nodules is not released to the soil on lopping but is utilized by the plant for vegetative growth.

31. Study of soil profiles and collection of samples for analysis the laboratory : In pursuance of the recommendations of the Expert Committee, a tour was undertaken in the South Mysore Coffee area (Hassan district and part of Mudigere taluk in the Chikmagalur district) and soil profiles selected for study. Field notes on the profiles were taken and samples collected horizon-wise. The description of the profiles thus studied given below. The chemical and mechanical analysis of the samples collected will be started in the very near future.

Soil Profile No. 1 : Location—Karadibetta estate, Old block. Sloping land under arabica.

- 0-12". Dark brown, moist, mottled slightly with quartz and parent rock with characteristic yellow coloration due to iron which turns brown on exposure.
- 12-24". Slightly lighter grey with more rock and leached and precipitated iron.
- 24-31". Very rocky, comparatively less soil, weathering rock in fractures shows blue colouration. Layer contains more quartz than the previous one.
- 31-52". Quartz layer mixed with sedimentary parent material. The fractures of the parent rock are slightly mottled with greyish specks.

Soil Profile No. 2 : Location—Karadibetta estate, Flat land under robusta.

- 0-12". Bleached greyish clayey soil interspersed with root rests and small pebbles. Very dry.
- 13-29". Coarse gravel and rock mixed with soil—rock mostly gravel. Dry.
- 29-52". Gravel and quartz mixed with soil, more reddish in colour than the previous layer, probably due to an accumulation of iron washed from above. Dry.
- 52-74". Remains of the weathered parent rock, full of greyish whitish small pebbles and pure quartz mixed together—reddish in colour. Dry.

Soil Profile No. 3 : Location : Ballupet. On gentle slope under arabica.

- 0-15". Top soil greyish, loose earth mixed with roots and small pebbles, some ferruginous.
- 15-30". Transition layer from soil to subsoil containing remains of weathered parent rock interspersed with moist soil and roots from shade trees. The section of parent rock is yellowish with some fractures showing greyish blue to steel blue colour.
- 30-45". Moist weathered rock mixed with sticky reddish clay with plenty of loose quartz.
- 45-58". Yellowish band with big sized quartz stones, traversed by shade tree roots and rootlets and small broken fragments of quartz.

Soil Profile No. 4 : Location—Thotadagadde estate, Saklespur Handi Uduve No. 2 Block. Gentle slope under arabica.

- 0-8 ". Dry, greyish reddish, top soil with plenty of coffee roots, slight concretions and remains of weathered rocks.
- 8-14". Reddish moist layer with bigger pieces of weathered rocks and coffee roots traversing it.
- 14-30". Reddish clayey wet layer with big lumps of weathered rock showing on fracture yellow iron oxide.
- 30-60". Clayey rocky layer consisting entirely of weathered rocks fractured faces showing yellowish iron and bluish blackish facets, penetration of roots is rather sparse.

Soil Profile No. 5: Location—Thotadagadde estate, Saklespur.

Gentle slope under young arabica.

- 0-13". Fairly moist, slightly clayey, yellowish greyish interspersed slightly with small quartz pebbles, roots sparse and coffee roots are confined more to top 5-6".
- 13-21". Layer more moist than top, richer in quartz, slightly reddish in colour.
- 21-40". Reddish whitish (rouge coloured) powdery full of fine quartz particles very friable micaceous soil.
- 40-53". Slightly reddish whitish interspersed with very fine sandy particles, soapy to the touch, more quartz and mica than the layer above.

Soil Profile No. 6: Location—Ossoor estate, Saklasapur.

Râté-mané block. Slope under young arabica.

- 0-24". Moist soil, dark greyish brownish with roots and rootlets of shade trees and coffee. Small concretionary imbedding of quartz and weathered parent rock.
- 24-29". Yellowish band mixed with lot of quartz.
- 29-60". Strata of quartz infiltrated with iron rich soil, roots of either shade trees or coffee scanty.
- 60-85". Reddish yellow clayey with small quantity of quartz intermixed.
- 85-110". Yellowish clayey moist layer intermixed with small quantity of weathered parent rock and quartz.
- 110-122". Yellowish strata with a deposition on either side of whitish micaceous clay looking very much like kaolin.

Soil Profile No. 7: Location. Ossoor Estate, Manjinakadu block. Sloping ground under arabica.

- 0-12". Greyish dark brown soil interspersed with roots and rootlets of coffee fairly moist.
- 12-27". Dark brownish grey layer mixed with quartz and bits of weathered parent rock which shows in the fracture greenish yellow streaks.
- 27-39". Quartz mixed with washed down soil from above showing occasional streaks of yellow and containing small bits of weathered parent rock which shows in fractured facets yellow and green colour.
- 39-54". Same description as above.

Soil Profile No. 8: Location—Cheekanahalli estate (Belur Taluk) Murthy Patte. Gentle slope under arabica.

- 0-9". Greyish whitish fairly loose soil with sparse coffee roots and roots of shade trees, no stones or pebbles. Dry.
- 9-18". Slightly moist whitish greyish layer, to a large extent free from rock pieces and pebbles.
- 18-27". Slightly moist mottled with whitish specks due to fractured quartz particles and dark bluish blackish spots surrounded by reddish specks.
- 27-36". Whitish yellowish greyish layer with the same kind of mottling in the layer above.
- 36-48". Same as above but the yellowish colour is more pronounced and reddish black spots are present in great number.
- 48-61". Yellowish deposition in the nature of a band mixed with white quartz particles.
- 61-66". Loose sandy layer with slight mottling due to ferric iron.

Soil Profile No. 9: Location—Biccode estate (Belur Taluk) Kolamara patte —undulating very gentle slope under arabica.

- 0-14". Greyish dark brown soil with coffee and shade tree roots with occasional quartz intrusions and small pebbles of probably the parent rock.

- 14-26". Quartzzy subsoil, greyish yellowish in colour with small pieces of parent rock mixed with the soils which show in the fractured surface greenish greyish colouration.
- 26-36". Modest, slightly clayey greyish greenish layer mottled with quartz, ferruginous particles and weathered parent rock.
- 36-56". Dark greyish greenish clayey moist compact layer mottled with quartz, ferruginous particles and weathered parent rock.
- 50-60". Dark greyish layer mottled with quartz particles and weathered parent rock.

Soil Profile No. 10 : Location—Hiregurge estate (Arehalli) 288 Block. Dark greyish moist friable soil mottled with small sized quartz pebbles with occasional black specks, slightly clayey.

- 9-18". Yellowish greyish, moist, friable, penetrated by shade tree roots, interspersed with pebbles.
- 18-27". Greyish yellowish face showing red and black spots with shade tree roots crossing the profile.
- 27-39". Greyish yellowish layer showing large areas of yellow spots suggestive of ferrous concretions probably weathered parent rock being cut while cutting the profile.
- 39-58". Yellowish layer mottled with black weathered parent rock last 2'' showing quartz intrusions, slightly micasuaus.

Soil Profile No. 11. Location—Bettadmane estate (Mudigere taluk). Medium slope under arabica.

- 0-11". Dry. Whitish greyish soil with plenty of small quartz and pebbles with rootlets of coffee.
- 11-20". Yellowish reddish layer, moist, profile face showing fine incrustations of quartz.
- 20-33". Reddish yellow whitish layer part of it moist, whitish portion mixed up with quartz and decomposed kaolin-like material
- 33-62". Whitish yellowish profile run through by reddish veins probably the result of deposition of leached iron. A whitish facing full of quartz but with yellowish ferrous infiltration.
- 62-78". A whitish profile with streaks of red and yellow running across it, consisting of fine sand and kaolin-like particles probably weathered parent rock.

32. **Laboratory work.** Work in the laboratory consisted mainly of routine analyses of soil and manure samples sent by planters and those collected by the department. Collection of leaf and petiole samples from the plants in the New Manurial Series was started in January and is being done every month. The analysis of this material of plant nutrients will be undertaken shortly and at the end of the year a correlation between manures applied and the nutrients status of the plant will be attempted. Samples from 10 types of green manure plants in the seed plot of the Botany section were collected and analysed. A few soil samples received from typical areas and which had been drawn from three depths, viz. 0-9", 9-18" and 18-27" were examined in a detailed manner in order to tentatively typify the soil for the area. Analyses of leaf samples that dropped during and at the end of S.W. monsoon were continued. Forty-nine samples of coffee sent by the Chief Coffee Marketing Officer were cup-tasted and a report sent to him. The results of these analyses are furnished below.

33. The number of determinations carried out during the year were as follows :—

Moisture	...	588	Lime requirement	...	225
Loss on ignition	...	236	Organic carbon	...	80
Total nitrogen	..	979	Available P_2O_5	...	44
Total P_2O_5	...	258	Available K_2O	...	44
Total K_2O	...	251	Mechanical analysis of	28	
Total CaO	...	66	soils	...	112
Total MgO	...	71	Clay analysis of	12	
R_2O_3	...	68	soils	...	36
Fe_2O_3	...	12	Carbon-di-oxide	...	1
Insoluble residue	...	83	Purity of copper sulphate	...	2
pH.	...	44	Specific gravity	...	98
Fat extraction in tung oil seed				...	1
Total					... 3299

34. **Analyses of green manures.** An area of 1 sq. ft. at random was marked out in the green manure seed plots of the Botany Section in each of the species grown. The plants in the area were cut just before flowering, at ground level, weighed and the stem and leaves separated and dried in the drying oven separately and weighed again. Analysis was conducted on the leaves and stem samples so obtained. The results of analyses are given in table XXIV and XXV.

TABLE XXIV—Analysis of Green Manure Plants

Green manure plants	Per sq. ft. area		analysis of leaves on oven dry basis					analysis of stems on oven dry basis					
	Leaf (oven dry samples) gms.	Steam (oven dry samples) gms.	Leaf Steam	Carbon	Nitro- gen (N ₂)	C/N	P ₂ O ₅	K ₂ O	Carbon C	Nitro- gen	C/N	P ₂ O ₅	K ₂ O
1. <i>Crotalaria anagyroides</i>	...	26.0	0.793	49.35	3.339	14.78	0.617	2.673	42.27	0.955	44.26	0.126	1.882
2. " <i>striata</i>	...	56.9	1.497	45.33	4.870	9.31	0.549	1.784	42.37	1.307	32.42	0.187	1.963
3. " <i>Grahamiana</i>	...	64.6	0.726	38.98	3.739	10.42	0.543	1.938	43.18	0.797	54.18	0.149	2.175
4. <i>Sesbania aegyptiaca</i>	...	4.3	0.782	46.54	3.071	15.17	0.450	2.025	45.73	1.054	43.38	0.212	2.489
5. " <i>aculeata</i>	...	7.4	0.565	50.05	1.824	27.45	0.431	2.124	43.67	0.795	54.93	0.178	2.427
6. " <i>speciosa</i>	...	34.2	0.213	49.72	3.123	15.92	0.380	1.744	41.98	1.004	41.81	0.112	1.401
7. <i>Tephrosia candida</i>	...	38.8	0.935	49.08	1.674	29.32	0.344	2.308	49.00	4.897	10.01	0.517	2.256
8. " <i>vogelii</i>	...	72.9	2.216	48.34	3.934	12.28	0.659	2.318	44.11	1.080	40.84	0.250	2.929
9. <i>Calapogonium mucunoides</i>	...	10.5	1.329	44.83	3.334	13.45	0.395	1.958	40.42	1.610	25.11	0.271	2.560
10. <i>Centrosema pubescens</i>	...	11.4	1.839	48.84	3.529	13.88	0.567	1.708	43.66	2.208	19.78	0.309	2.608

TABLE XXV—Analysis of Green Manure Plants—Yield Records

NAME OF GREEN MANURE PLANT	Yield per sq. foot area		Mois- ture	Plant nutrient content in green manure from 1 sq. foot area		
	Green weight gms.	Dry weight gms.		Nitro- gen	P ₂ O ₅	K ₂ O
1. <i>Crotalaria anagyroides</i>	... 358	58·4	83·69	1·178	0·201	1·305
2. <i>Crotalaria striata</i>	... 440	94·9	78·43	3·268	0·384	1·762
3. <i>Crotalaria Grahamiana</i>	... 720	153·6	78·67	3·124	0·483	3·188
4. <i>Sesbania aegyptiaca</i>	... 44	9·8	77·73	0·190	0·031	0·222
5. <i>Sesbania aculeata</i>	... 79	20·5	74·05	0·239	0·056	0·476
6. <i>Sesbania speciosa</i>	... 709	195·0	72·49	2·682	0·310	2·848
7. <i>Tephrosia candida</i>	... 350	80·3	77·06	2·668	0·345	1·813
8. <i>Tephrosia vogelii</i>	... 759	105·8	86·06	3·189	0·562	2·653
9. <i>Calapagonium mucunoides</i>	... 79	18·4	76·71	0·478	0·063	0·408
10. <i>Centrosema pubescens</i>	... 62	17·6	71·61	0·528	0·084	0·355

1. ***Tephrosia vogelii*, *Crotalaria striata*, *Calapagonium mucunoides* and *Centrosema pubescens*** have all more leaf than stem as shown by the leaf/stem ratio. *Sesbania speciosa* has the lowest leaf/stem ratio. However, this is more than compensated by the large bulk obtained.

2. **Nitrogen and C/N ratio.** All the green manure plants analyzed have more than 3 % Nitrogen in the leaves except *Sesbania aculeata* and *Tephrosia candida*. *Crotalaria striata* has 4·87 per cent. In stems, three plants have less than 1 per cent, five between 1 and 2 per cent, one between 2 and 3 per cent and one between 4 and 5 per cent. *Tephrosia candida* which has the lowest percentage of nitrogen in leaves has the highest percentage in stems.

Leaves of *Crotalaria striata* and *C. Grahamiana* have very low C/N ratios and therefore must be capable of being broken down very easily. *Tephrosia candida* leaves have the highest C/N ratio about three times that of *Crotalaria striata*. The C/N ratio of stems of *Tephrosia candida* is very low and is about 1/3 that of the leaves. *Calapagonium mucunoides* and *Centrosema pubescens* have comparatively lower C/N ratios than the rest of the green manure plants.

3. **P₂O₅ & K₂O:** The average P₂O₅ content of the leaves of the green manure plants lies at about 0·5 per cent. All the crotalarias examined, have a value above this. *Tephrosia vogelii* and *Centrosema pubescens* have P₂O₅ content higher than this average value. The lowest P₂O₅ content is found in *Tephrosia candida* leaves. In stems, five plants have a P₂O₅ content between 0·1 and 0·2 per cent, three between 0·2 and 0·3 per cent, one between 0·3 and 0·4 per cent and one between 0·5 and 0·6 per cent. *Tephrosia candida* stems have the highest percentage of P₂O₅.

The average K₂O content of the leaves of the green manure plants is 2·1 per cent. Five plants have K₂O content above 2 per cent and five below 2 per cent. *Crotalaria anagyroides* leaves have the highest percentage of K₂O. In stems, the K₂O content is on the average about 2·25 per cent. Only three, namely *Crotalaria anagyroides*, and *C. striata*, and *Sesbania speciosa* have less than 2 per cent K₂O. *Tephrosia vogelii* has the highest percentage of K₂O in stems.

Crotalaria striata, *Tephrosia vogelii*, *Crotalaria Grahamiana*, have all high plant nutrient content. *Tephrosia candida*, *Sesbania speciosa* and *Crotalaria anagyroides*, have medium plant nutrient content. *Sesbania aegyptiaca* and *S. aculeata*, *Calapagonium mucunoides* and *Centrosema pubescens* produce very small quantity of plant nutrients per acre.

From all points of view *Crotalaria striata* and *Tephrosia vogelii* appear to be the best green manure plants of the ten studied.

• 35. The chemical and mechanical analysis of a number of soil samples received from a few coffee growing areas of S. India have been carried out. The following brief description gives the main features of each locality. The detailed analytical data and discussions will be published elsewhere.

(i) *Locality*—Brahmagiri and Narikallu estate—Malabar Wynaad.

The soils are sandy loames and are open. The total nitrogen content varies from 0.097 to 0.200%, total phosphoric acid from 0.561 to 0.153%, total potash from 0.187 to 0.316%. The available phosphoric acid varies from 0.552 to 4.34 mgms. per cent and available potash from 20.41 to 49.32 mgms. per cent. Thus although the soils from a plant nutrient status view point are fairly good, the available phosphoric acid is very low.

(ii) Balur estate, Mudigere-Mysore.

The soils tend to be heavy as the coarser fractions are about $\frac{1}{3}$ of the total. Total nitrogen varied from 0.189 to 0.283, total phosphoric acid from 0.148 to 0.268, total potash from 0.301-0.388. The available phosphoric acid varies from 8.4 to 46.3 mgms. per cent and available potash from 28.1 to 68.8 mgms. per cent. Thus the soils are quite fertile and the need for soil management to make it more open and to improve the physical structure, is indicated.

(iii) Kolarkhan estate—Mysore.—Outcrops of Bababudangiri.

The coarse sand fraction here is low and here again the coarse fractions are about $\frac{1}{3}$ of the total. The total N varies from 0.167 to 0.283, the total P_2O_5 from 0.131-0.191 the total K_2O from 0.223-0.250. The available P_2O_5 varies from 1.60-27 mgms. % and available potash from 3.9-5.33. Thus although the soils are quite fertile, the limiting factors appear to be the low available P_2O_5 and K_2O . Soil management to improve the physical structure and the available phosphoric acid and potash is necessary.

(iv). Quard Hitlow group, Koppa—Mysore.

The coarse sand fraction is about a third of the total. However the fine sand is very low. Thus the coarser fractions are about 37% of the total. The soils tend to be heavy. The total nitrogen varies from 0.126 to 0.192 per cent, total P_2O_5 from 0.098 to 0.123 per cent, total K_2O from 0.320-0.362%. The available P_2O_5 varies from 4.51-10.52 mgm.% and the total K_2O from 5.8 to 11.6 mgms. %. Although the soils are above average fertility, their clayey nature and low available phosphoric acid and potash content would cause low crops. Here again soil management to improve the physical structure and increase available potash and phosphoric acid is indicated.

(v). Singampatty group—Tinnevely, Madras.

These soils represent the southern most area of the coffee growing tract of S. India. The soils preponderate generally in coarse fractions and are therefore more open and well drained. The total nitrogen, phosphoric acid and potash varies from 0.105-0.496%, 0.069-0.171% and 0.081-0.516% respectively. The available phosphoric acid varies from 1.7 to 6.0 mgms.%, the available potash from 3.5 to 40 mgm %. Generally the soils are rich in totals and poor in availables.

36. **Cup-tasting of Coffee samples:** Forty-nine samples of arabica parchment sent by the Chief Coffee Marketing Officer, Indian Coffee Board, Bangalore were assessed by the Chemist for raw, roast and liquor. The specific gravity of the bean and the liquor was also determined.

37. Comparison of the Colorimetric method of the A.O.A.C. (p. 127, 128, 1945) with the official volumetric method of A.O.A.C. for the *determination of available phosphoric acid in soils*:

A comparison of the methods was tried on 24 samples and it was found that the colorimetric method which is far quicker gave values very near to those obtained by the official volumetric method as the following table shows.

TABLE XXVI—Determination of available phosphoric acid in soils

SAMPLE			P ₂ O ₅ in mgms.		SAMPLE			P ₂ O ₅ in mgms.	
			Colori- metric	Volu- metric				Colori- metric	Volu- metric
<i>Sidapur Estate—</i>					<i>BBTC Coils</i>				
1.	do	No. 1	17·81	19·83	13.	Manjolai	1	5·22	
2.	do	2	5·59	5·41	14.	do	2	2·46	2·63
3.	do	3	1·64	1·20	15.	do	3	2·30	2·82
4.	do	4	1·50	1·20	16.	Kakachi NC.	1	2·69	2·82
5.	do	5	0·47	traces	17.	do	2	1·77	2·25
6.	do	6	0·16	traces	18.	do	3	1·46	1·69
7.	do	7	0·78	traces	19.	Oothu KV	1	4·03	4·66
8.	do	8	0·47	traces	20.	do	2	1·39	1·65
9.	do	9	0·53	traces	21.	do	3	2·16	2·25
10.	do	10	1·76	2·03	22.	Kakachi Old	1	4·74	5·02
11.	do	11	1·22	1·73	23.	do	2	1·54	1·80
12.	do	12	1·08	1·25	24.	do	3	1·99	1·95

It is possible to determine the P₂O₅ by the simpler colorimetric method even when it is present in such small quantities that it cannot be determined by the volumetric method.

38. **Abnormal leaf-fall:** The following table gives the analysis of leaves which had fallen from coffee plants which were green and apparently healthy and those that were picked from the plants. This leaf-fall usually occurs after a wet spell and was noticed first in the Bababudangiris. Complaints about abnormal leaf-fall of this type are being received now from all over the coffee areas. The following table gives the analysis of leaves received from Nilgiris and an estate near the Coffee Research Station Balehonnur.

TABLE XXVII—Analyses of coffee leaves

DESCRIPTION OF SAMPLE	N.	P ₂ O ₅	K ₂ O	Org- anic carb- on	CaO	MgO	R ₂ O ₃	Ins. Resi- due	Loss on igni- tion	C/N
<i>Healthy Leaves</i>										
1. C.R.S. Balehonnur	2.62	0.702	1.92	36.6	2.71	0.19	1.68]	2.95	69.7	13.97
2. Nilgiri Neergundi estate	2.94	0.89	1.1	40.3	2.14	0.2	0.08	0.38	90.6	13.69
3. do Young healthy leaves	3.45	1.15	1.72	40.3	0.89	0.19	0.68	0.62	93.8	11.66
4. Old fallen leaves Nilgiri Neergundi-estate	2.72	1.21	1.09	39.3	1.24	0.55	0.37	0.74	93.4	14.42
<i>Guntanaik Estate Balehonnur</i>										
Petioles from—										
1. Healthy robusta leaves	23.73	0.41	4.06	38.5	5.7	...	...	0.42	88.0	1.62
2. Fallen apparently healthy robusta leaves	27.73	0.21	3.38	38.5	9.3	...	...	0.61	89.3	1.39

It will be noticed from the above that in the leaves of the Nilgiri Neergundi estates, N & K are higher in the healthy leaves than in the diseased ones. The C/N ratio is higher in the diseased leaves. The cause for the chlorosis on account of which the analysis was undertaken can be traced back to this. There must have been acute carbohydrate deficiency in the plants, and the young leaves could not have been able to obtain the necessary carbohydrate for their growth. In the young healthy leaves organic carbon and nitrogen are higher than in the fallen leaves. This shows that in order to provide for the flush being produced the essential carbohydrates and nitrogen were being withdrawn from the older leaves. The stage had not yet been reached when the amount of carbohydrates produced by the young leaves would be in excess of their requirements and could be fed to the other parts of the plant. Chlorosis due to carbohydrate deficiency has been noticed in Kenya and commented upon by Periera and others. The phenomenon in last year's report is of quite a different origin. The reason for this apparently contradictory phenomenon is difficult to explain.

From comparative studies of the ratios of the plant foods found in the petioles of healthy and fallen leaves it can be seen that the ratios are much higher in the latter than in the former showing an excessive accumulation. This may be due to the hindrance caused to the free movement of foodstuffs as a result of the shot-hole borer attack from which the plants suffered.

C. AGRONOMY

39. Following were the agronomic investigations conducted during the year under report.

1. Influence of pruning on yields.
2. Pruning and manurial experiments on robusta.
3. Study of basic yields for standardisation of experimental plots.
4. Effect of weed killers.
5. Single v. multiple stem of growing coffee.
6. Seed germination tests.
7. Mulching experiments.
8. Conditions favouring vegetative propagation.
9. Topping experiments on robusta.

40. Influence of pruning on yields

(a) *Arabica*. The results of experiments started in 1946 are furnished below.

Locality-Ghattedhulla (Coorg)
Area of Exptl. plot: 2.71 acres.
Variety: arabica (Coorgs)
Shade: Natural shade
Variants: 5.

Layout: Latin square 5 x 5
Area of each sub-plot:
Nett 10 x 10 or 100 plants
 (1/12 acre)

Treatments

- A. Light hot weather prune.
- B. Light monsoon prune.
- C. Medium hot weather prune.
- D. Medium monsoon prune.
- E. Control—no prune.

TABLE XXVIII—Effect of pruning on yields

TREATMENTS	Ripe cherry in lb. per acre				Clean coffee in cwt. per acre				CALCULATED Clean coffee in cwt. per acre			
	1946	1947	1948	1950	1951	1952	1946	1947	1948	1950	1951	1952
A.	...	1346	2706	1754	1834	643	2.67	4.03	2.61	2.73	3.37	0.96
B.	...	1224	2530	1782	1889	866	2520	3.76	2.65	2.81	3.75	1.29
C.	...	1020	3196	1686	1812	780	2253	4.76	2.51	2.70	3.35	1.16
D.	...	938	2652	2176	1915	722	2153	3.95	3.24	2.85	3.06	1.07
E.	...	1510	2708	2285	1509	660	2453	4.03	3.40	2.25	3.65	0.98
	...	1208	2758	1937	1759	732	2293	4.10	2.88	2.62	3.41	1.098
	...	Yes	No	No	No	No	No	No	No	No	No	No
G. Mean	...	10.70	12.11	20.30	18.47	16.59	10.70	12.11	20.30	18.47	6.91	16.59
Sig. or not	...	378	975	1164	932	374	0.52	1.45	1.73	1.39	1.09	0.56
Std. error	...	EABCD	CAEBD	CBADE	DBCAE	BCDEA						
Crit. diff.	...											
Conclusions	...											

It is found that there are no significant differences among the four methods of pruning and control (no pruning).

(b) *Robusta*: Another series of experiments was started in Coorg at (1) Yemmigoondi, (2) Pollibetta and (3) Cannoncadoo estates for the study of the effects of pruning on *robusta*.

The following were the treatments tried.

- A. Thinning out.
- B. Heading back.
- C. Control (no pruning).

Thinning out indicates removal of thin and weak branches and twigs which are less prone for cropping. This is done by the removal of those branches at their points of origin or at a place from where vigorous new shoots are expected to be formed. The object of thinning is to space the remaining branches and twigs to better advantage and to grow the plant generally to a desired shape and spread. The centering was done to a distance of 6 inches of the main stem.

Heading back. By this method, cropping of completely new wood instead of on extension growths of the current cropping branches is done. Just after the blossom, the terminal shoots are cut out beyond the last node with flowers. This stimulates new wood formation nearer the base of the cropping wood. When the crop is removed during the succeeding year, those parts of the branches which had borne the crop are cut off. The usual centering to 6 inches was also done.

The results of the first crop will be recorded during the ensuing harvest.

41. Pruning and manurial experiments on *robusta*. On the suggestion of the Research Committee, two sets of experiments have been laid out, one at Badra estate and the second at Devadhanam estate in Mysore. The treatments have been laid in latin square design 5 x 5 with sub-plots of 6 x 10 plants spaced 8' x 8'. The treatments are as follows—

- A. Control.
- B. Pruning but no manuring.
- C. Manuring at levels of 40-30-40 of N. P. K. but no pruning.
- D. —do— —do— 80-30-40 of —do— —do—
- E. —do— —do— 40-30-40 of —do— and pruning in Feb. March.
- F. —do— —do— 80-30-40 of —do— and pruning in Feb. March.

Half the dose of nitrogen was applied as pre-blossom dose in the form of ammonium sulphate. The balance of manure was applied in September. The experiment is in progress.

42. Study of basic yields for standardisation of experimental plots. To find out the most suitable method of soil management in old coffee, a replicated experiment was laid out in July 1949 on a latin square design. Preliminary yield records were taken from the individual plots in order to standardise the plots prior to carrying out the treatments: The yields of the plots are given below.

<i>Locality</i> : Chethalli (Coorg)	<i>Area of each plot</i> :
<i>Layout</i> : 6 x 6 latin square.	<i>Gross</i> : 16 x 10 plants.
<i>Variants</i> : 6	<i>Nett</i> : 14 x 8 plants.
<i>Variety</i> : Arabica (Coorgs)	<i>Shade</i> : Natural shade
<i>Age</i> : About 20 years.	

TABLE XXIX—The result of cultivation experiment

No.	Symbol	PROPOSED TREATMENT	YIELD PER ACRE						
			Ripe cherry in lb.			Calculated yld. of clean coffee cwt.			
			1950	1951	1952	1950	1951	1952	
		<i>Plot for—</i>							
1.	A.	Trenching 1½ ft. deep	711	1362	193	1·26	2·03	0·29	
2.	B.	Trenching ¾ ft. deep	813	1040	145	1·45	1·55	0·22	
3.	C.	Renovation pitting	618	1004	126	1·10	1·49	0·19	
4.	D.	Light digging	488	856	182	0·87	1·27	0·27	
5.	E.	Heavy digging	588	810	150	1·05	1·21	0·22	
6.	F.	Control, only removing weeds	569	1395	167	1·01	2·08	0·25	
		Mean	631	1078	161	1·12	1·61	0·24	
		Crit. difference	464	754	68	...	1·12	0·10	
		S.E.M. %	24·9	23·7	14·26				
		Conclusions	BACEFD FABCDE ADFEBC						

The results indicate no difference between basic yields of the plots, but the standard errors are high.

43. **Replicated trials of Agronomic practices.** As a complement to the non-replicated trials to the agronomic practices opened last year a similar long-range experiment was marked out with four fold replication in permanently laid-out plots on the 'O' and 'M' blocks of the Station. The treatments proposed embody all the possible combinations of different periods of manuring time and depth of cultivation in vogue, mulching and pruning as noted in table. The object of the experiment is to find out the most suitable combinations of agronomic practices for getting enhanced yields in coffee under the varying ecological conditions of shade, depth of soil and fertility. The yields were recorded in Nov-Dec. 1951 from individual plots, laid out in advance to standardise the plots prior to the application of the treatments from January 1952. The basic yields recorded are given in table XXX on page 43. There is no significant difference between sets of plots aligned for the different treatments during the pre-treatment period.

Locality: Balehonnur (Mysore)

Year: 1951-52

Layout: Randomized blocks.

Variety: Coorgs.

Replications: 4.

Treatments: 14.

Size of plot

	Gross.	Nett.
Repl. I, II & III.	18 x 8	16 x 6
	144 plants.	96 plant points of 5.51 cents.
Repl. IV.	15 x 8	13 x 6
	120 plants.	78 plant. points of 4.48 "

44. Single v. multiple stem system of growing coffee:

EXPERIMENT I.

Locality: Balehonnur (Mysore) *Layout:* AB BA pattern
Variety: 288,333,433,434 and *Plot:* 6 x 16.
 Kent (each variety *Spacing:* 6' x 6'
 having 12 rows of *Age plants:* 6 years (from seed)
 16 plants in each row)
Treatments: 2. *Shade:* Natural shade.
Replications: 6. *Period of conversion:* May 1950
Area of Exptl. block: 95.2 cents.

Treatments:

- A. Plants on single stem.
- B. Plants on multiple stem (three suckers).

TABLE XXXI—Yield records of plots on single & multiple stem

PLOT	VARIETY	Yield of ripe cherry (actual) in lb. and calculated yield of clean coffee in cwt. per acre (1,200 plants)						
		A. SINGLE STEM			B. MULTIPLE STEM			
		Ripe lb.	Cherry oz.	Clean cwt.	Ripe lb.	Cherry oz.	Clean cwt.	
1.	288	...	63	1	1.17	20	8	0.38
2.	333	...	82	8	1.53	8	3	0.15
3.	Kents	...	18	12	0.35	6	15	0.13
4.	433	...	7	3	0.13	3	14	0.07
5.	434	...	22	6	0.42	5	1	0.09
6.	Kents	...	21	10	0.40	3	6	0.06

N. B. — Six pounds of ripe cherry has been taken to yield 1 lb. of clean coffee.

The yield from multiple stem plots was low during the first crop year after conversion, but the standing crop is quite good.

EXPERIMENT II.

Locality: Balehonnur (Mysore) *Layout:* Randomized block.
Variety: Arabica (Hybrid). *Plot:* 4 x 16
Treatments: 4 *Spacing:* 6' x 6'
Replications: 5 *Age of plants:* 19 years from seed
Shade: Natural Shade. *Period of conversion:* March 1951
Area of experimental block: 105.8 cents.

Treatments:

- A. Single stem.
- B. Primary branches on one side were pruned off during the year of conversion to multiple stem to encourage free development of suckers.
- C. Extended centring up to one foot from the centre was done during the year of conversion to multiple stem to facilitate free development of suckers.
- D. Except the top two primary branches all the other branches were cut during the year of conversion to multiple stem to facilitate free development of suckers.

TABLE XXXII—Average record of yield from Single stem and Multiple stem plots

TREATMENT		Ripe cherry (actual) in lb.	Calculated yield of clean coffee in cwt. per acre (1,200 plants)
A.	...	38·63	1·08
B.	...	22·11	0·70
C.	...	24·62	0·78
D.	...	38·38	1·07

EXPERIMENT III*Locality:* Balehonnur (Mysore)*Layout:* AB BA pattern.*Variety:* Arabica (Hybrid)*Plot:* 16 plants in a row.*Treatments:* 2*Spacing:* 6' x 6'*Replications:* 21*Age of plants:* 8 years from seed.*Shade:* Natural shade*Period of conversion:* March 1951.*Area of exptl. plot:* 56 cents.*Treatments*

A. Single stem.

B. Multiple stem.

TABLE XXXIII—Average record of yield from single stem and multiple stem plots

TREATMENT		Ripe cherry (actual) in lb.	Calculated yield of clean coffee in cwt. per acre of 1,200 plants
A. Single stem	...	5·78	0·64
B. Multiple stem	...	3·9	0·44

During the year of conversion the plants under conversion to multiple stems have given a sizeable crop.

45. **Effect of Dicotox (Weed-killer) on coffee.** During the previous year's experiments in a field of robusta coffee, the drift of the spray fell on some plants. It caused crinkling of leaves especially on the new growth and this persisted throughout the life of the leaves.

46. **Seed germination tests.** Seeds of S. 645 prepared under similar conditions during December 1951 were sown every fortnight from 1st Jan. 1952 to end of the official year and continued further. The sowings were replicated three times using 100 seeds for each replication. The seeds were sown in nursery beds and these were kept unprotected during the rainy months. The results of the germination as at the end of October 1952 are tabulated below.

<i>Date of sowing</i>	<i>Percentage of germination (average of 3 replications)</i>
1-1-1952	96.33
15-1-1952	95.33
1-2-1952	98.33
15-2-1952	92.00
1-3-1952	93.00
15-3-1952	87.67
1-4-1952	88.33
15-4-1952	71.33
1-5-1952	51.00
15-5-1952	51.00
1-6-1952	50.33
15-6-1952	16.67

Observations are being continued on the germination of seeds sown during the later fortnights. However it is noticed that if sowings are delayed, the seeds take a proportionately longer time to show the first signs of germination and there is a gradual deterioration in the germination from sowings made later than the third month after preparation of seed.

47. Studies in the germination of coffee seeds. A small scale experiment was started to find out the viability of germination of arabica seed (1) with parchment cover intact, (2) cover partially split, and, (3) cover completely removed. The experiment was started on 2nd January 1952: Seeds of S. 288 were taken as the material for the experiment. A small sample of the wet parchment seeds was sown, half with the seed cover intact, and half with the covers split open on the day when pulping was done. Half the quantity of the seeds prepared was treated with wood ash and the other half was left untreated. Both were dried under shade for a week. When sufficiently dry, each of the above lots was divided into further sects. Half of each lot was divided into 6 aliquots and placed in air-tight tins, for periodical sowings and the balance under each, stored in small gunnies. Thus there were 4 treatments for each of the monthly sowings done from January as detailed below—

1. Treated with ash and stored in air-tight tins.
2. Treated with ash and stored in gunny.
3. Not treated with ash but stored in air-tight tins.
4. Not treated with ash but stored in gunnies.

Sowings were done under replication at monthly intervals with the following sub-treatments for each of the above main treatments—

- A. Seeds sown after pricking or puncturing the parchment cover.
- B. Seeds sown with the seed cover intact.
- C. Seeds sown after completely removing the parchment cover at the time of sowing.

Just prior to storing the seeds, the second set comprising seeds coated with ash and not coated, was sown. The rest of the sowings from February to May consisted of $4 \times 3 = 12$ treatments randomized and replicated 4 times. Seeds were sown on open beds in the nursery on prepared soil at $\frac{1}{2}$ " depth by using a sowing board, lightly covered with soil, mulched with straw and regularly watered. Of the five sets of sowings from 2-1-52 to 4-4-52, seeds sown after completely removing parchment cover at sowing were found to germinate 15 to 20 days earlier, those with split parchment cover a week to 10 days in advance compared to the seeds sown with parchment cover intact. The difference should be attributed to the quicker absorption of water by the seeds in the first two treatments. Those without parchment cover were able to push out the radicles earliest. Sowings in April and May suffered some loss in germination due to the smothering effect of the showers that followed when the mulch was removed. Seeds without seed cover escaped the bad effects by their earlier germination compared to the rest. The last set sown in May had also attack of "damping off" in patches. In spite of spraying with Bordeaux mixture germination was affected. But in all the periodical sowings there was no significant difference in the percentage of germination between the three sub-treatments, where variations of method of storing and pre-treatment (with ash) had been introduced at the outset. The results are given in tables below:—

RECORD OF GERMINATION PERCENTAGE WITH AGE AND TREATMENT OF ARABICA COFFEE SEEDS

TABLE XXXIV.—Set I. Sown on 2-1-52 immediately after pulping

No. Symbol	TREATMENT	Mean No. germinated	% of germination	REMARKS
1. A.	Wet parchment seed sown after splitting open parchment cover...	18·0	90·0	Five replications (20 seeds each.) Sown in <i>AB BA</i> pattern.
2. B.	Wet parchment seed sown with cover intact	...	19·0	
	Mean	...	18·5	
	S. E. Deviation	...	0·45	
	Sig. or not	...	No.	
	Critical difference	...	2.2	
	Conclusions	...	Both equal	

TABLE XXXV.—Set II. Sown on 7-1-1952 just before storing

No.	TREATMENT	Mean No. germinated	% of germination	REMARKS
1.	Treated with ash, parchment cover split and sown	...	18·0	90·0
2.	Treated with ash, sown with parchment cover intact.	...	18·0	90·0
3.	Treated with ash, sown after removal of parchment cover	...	18·0	90·0
4.	Not treated with ash, parchment cover split and sown	...	18·4	92·0
5.	Not treated with ash and sown with parchment cover intact	...	18·2	91·0
6.	Not treated with ash, sown after removal of parchment cover	...	18·8	94·0
	Mean	...	18·2	91·1
	Significant or not	...	No.	
	S. E. M. %	...	2·6	
	Conclusions	...	All equal	

TABLE XXXVI.—Sets III, IV & V (Randomized and replicated at 20 seeds per replication)

TREATMENT	Set III Germination		Set IV Germination		Set V Germination	
	Mean	%	Mean	%	Mean	%
Date of sowing	8-2-52		7-3-52		4-4-52	
A. Treated with ash and stored, parchment cover split open at sowing ...	18.8	93.8	19.0	95.0	17.3	86.3
B. Treated with ash and stored, parchment cover intact ...	19.5	97.5	17.3	86.2	16.0	80.0
C. Treated with ash and stored, parchment cover completely removed ...	19.0	95.0	19.0	95.0	16.0	80.0
Not treated with ash; stored: parchment cover—						
D. Split open, at sowing ...	17.0	85.0	17.8	88.8	13.3	66.2
E. Intact " " ...	17.8	88.8	18.0	90.0	12.5	62.5
F. Removed completely at sowing ...	18.5	92.5	19.0	95.0	13.3	66.2
Not treated with ash; not stored: parchment cover—						
G. Split open, at sowing ...	18.5	92.5	16.3	81.2	14.0	70.0
H. Intact " " ...	17.0	85.0	16.5	82.5	12.3	61.5
I. Removed completely at sowing ...	18.5	92.5	16.8	83.8	13.0	65.0
Treated with ash; not stored: parchment cover—						
J. Split open, at sowing ...	17.5	87.5	15.8	78.8	13.0	65.0
K. Intact " " ...	17.3	86.2	15.5	77.5	12.5	62.5
L. Removed completely at sowing ...	18.8	93.8	15.8	78.8	14.0	70.0
Mean	18.1	90.8	17.2	86.0	13.9	69.2
Significant or not	No		No		Yes.	
Critical difference			4.1		2.9	
S. E. M. %	2.6				6.8	
Conclusions	All equal		All equal		ABC, GLDFIJEKH	

The investigations were further pursued to find out any possible difference in growth between the seedlings raised from seeds with and without seed cover at sowing. For this, seedlings available from a similar experiment conducted last year with seeds of S.288 had been transplanted on the nursery beds. Height measurements and number of nodes of eight pairs of plants from each of three sets taken on 1-7-1952 are given below—

TABLE XXXVII.—Growth and number of Nodes on Plants Transplanted in Nursery Beds

Set	Symbol	PARTICULARS OF TREATMENT	DATE OF		AVERAGE		Sig. or not
			Sowing	Trans-planting	Height of plants ft.	No. of nodes	
I.	A. 28	Seedlings raised from seeds with parchment cover intact.	23-2-51	4-8-51	1.44	11.38	No.
	A. 45	—do— without parchment cover	... —do—	—do—	1.53	10.0	No.
II.	B. 13	—do— with parchment cover intact	... 6-3-51	6-8-51	1.00	11.12	No.
	B. 34	—do— without parchment cover	... —do—	—do—	1.22	10.12	No.
III.	C. 21	—do— with parchment cover intact	... 24-3-51	8-8-51	1.95	11.70	No.
	C. 45	—do— without parchment cover	... —do—	—do—	1.63	12.30	No.

Analysis of the data failed to show any significant difference at the end of nearly a year after planting. These had been planted in beds 9 inches apart in August 1951, which had a light dose of cattle manure at the time of the preparation of the beds. Earlier germination of the seeds without parchment cover is no doubt helpful for transplanting the seedlings in the baskets or nursery beds 2 to 3 weeks earlier. But at the end of the year, differences due to earlier germination, noted at the time of transplanting, were not reflected under conditions of the nursery bed. It has therefore to be concluded from these trials that any damage to the parchment cover at the time of sowing does not impair the germination capacity nor the growth of seedlings raised from them.

48. **Mulching experiments.** Experiments conducted at Moshi in E. Africa on coffee grown on high elevations without shade have shown that the crop is benefited by the application of banana mulch. A similar experiment was started on young coffee 2 years old last year on the 'G' block growing under light mixed shade. The experiment was laid out in latin-square design with 4 variants. The first application of mulch and green leaves to the respective plots was made from February to April 1951. For the second year, they were applied in November and December besides ratooning and mulching *Crotalaria anagyroides* grown *in situ*. The plants have been topped at $2\frac{1}{2}$ ft. Length of the longest branch of the plants in the central rows in all the treatments was recorded in November 1951 and again towards the end of June 1952. Average extension in growth per unit length of each of the branches was calculated and analysed. The results do not show any significant difference.

TABLE XXXVIII.—Results of mulching experiment

No.	Symbol	T R E A T M E N T		Average increase in length per plant per branch	
1.	A.	Banana trash @ 40 lb. per plant	...	0.42 cms.	
2.	B.	Green leaves @ —do—	...	0.39 cms.	
3.	C.	Control (no application)	...	0.39 cms.	
4.	D.	<i>C. anagyroides</i> grown <i>in situ</i> cut and mulched.	...	0.33 cms.	
		Mean	...	0.38 cms.	
		Significant or not: No.	...	0.13	
		S. E. M. % 9.97	Conclusions	...	All equal

49. **Topping experiments in robusta.** This investigation was started on the suggestion of the Research Committee. Two sets of plots were laid out one at Byregudda near Balehonnur and the other at Murkull in November 1951 adopting ABBA pattern with 12 replications. Each plot contains 8 x 4 plants. The spacing in the former place is 9' x 9' and the latter 8' x 8' and the plants 3 and 4 years respectively. The plants were topped at 3 feet and 4 feet levels. Observations will be taken and the yields will be recorded through a period of ten years.

50. **Conditions favouring vegetative propagation of coffee.** This experiment was started towards the end of June 1951. The main object of the investigation is to find out the optimum concentrations of different factors promoting growth (such as auxins, carbohydrates and nitrogen), to produce high percentage of rooting in sucker cuttings. The material consisted of single-noded leafy cuttings gathered from 4-noded suckers obtained from leaf-disease susceptible arabica of over 30 years old. Of the three treatments, those which were treated for 48 hours sustained high mortality. The cuttings planted in July 1951 were examined in December 1951 for their root production. Records of the percentage of cuttings living, cuttings rooted and the measurements and number of roots were averaged for each treatment. The results are summarised in tables XXXIX and XL.

1.	2	3	4	5	6	7	8	9	10	11	12	13	14
5. C.A. —Combination of 1 & 3. Cuttings dipped for the 1st half period in C, and then in A													
I. Inter node	...	67	55	5.5	12.4	25.81	3.13	100	100	7.25	8.77	14.12	3.15
II. Inter node	...	100	83	3.7	4.5	15.96	2.68	100	75	3.0	4.75	2.50	0.50
III. Inter node	...	100	60	4.02	7.6	...	...	100	50	R	R	...	...
IV. Inter node	...	80	60	R	...	...	...	100	25	R	...	...	...
6. N.A. —Combination of 2 & 3. Cuttings dipped for the 1st half period in N, and then in A													
I. Inter node	...	100	83	8.25	8.64	22.96	2.82	100	100	6.4	11.1	27.43	3.71
II. Inter node	...	100	86	5.0	4.4	11.67	1.80	100	100	4.5	8.60	11.91	1.32
III. Inter node	...	100	50	4.3	4.5	6.39	0.59	100	75	R	...	...	...
IV. Inter node	...	100	43	1.67	6.0	1.3	1.5	100	67	1.5	3.7	...	...
7. C.N.A. —Combination of 1, 2 & 3. Applied as in 5 or 6													
I. Inter node	...	100	100	6.5	9.92	16.43	7.36	100	100	4.75	12.42	26.5	3.79
II. Inter node	...	100	75	6.0	7.03	16.0	4.35	100	100	5.75	9.60	15.85	1.93
III. Inter node	...	100	67	3.0	4.05	8.33	1.41	100	67	4.0	6.5	8.0	2.6
IV. Inter node	...	80	60	1.0	5.0	0.6	0.07	100	67	5.0	9.7	20.2	3.0
8. U.E. —Cow's Urine Extract. 1% solution of Alcoholic extract in water													
I. Inter node	...	80	80	5.2	10.05	28.09	5.09	Nil	Nil	...	...	...	...
II. Inter node	...	80	80	2.0	4.7	13.7	2.0	100	100	4.0	8.25	11.67	2.54
III. Inter node	...	80	60	2.67	3.1	...	...	100	50	2.5	2.23	7.81	1.60
IV. Inter node	...	60	60	3.0	7.7	7.58	0.92	100	C	...	...	...	...
9. Ph. —Phosphoric acid—0.5 solution of Ammonium phosphate													
I. Inter node	...	67	67	3.3	9.1	28.61	3.46	100	100	5.5	9.12	14.61	2.24
II. Inter node	...	67	50	6.33	8.53	19.31	2.92	100	100	5.75	4.67	1.89	0.38
III. Inter node	...	100	33	R	R	...	...	100	25	1.0	3.5	...	...
IV. Inter node	...	100	20	R	R	...	...	100	30	...	...	...	...

1.	2	3	4	5	6	7	8	9	10	11	12	13	14
10. Canesugar — 2 % solution in water													
I. Inter node	...	67	50	R	...	...	...	100	80	5.2	11.45	24.41	3.36
II. Inter node	...	100	38	4.5	7.6	16.47	2.88	100	80	2.0	3.16	5.0	1.0
III. Inter node	...	100	33	1.0	C	...	...	100	60	2.0	Nil	...	...
IV. Inter node	...	100	C	...	...	...	...	100	50	3.0	1.0	5.0	0.5
11. KmnO_4 — Potassium permanganate 0.1% solution													
I. Inter node	...	100	67	4.67	13.5	20.67	3.50	100	100	4.8	13.12	23.08	4.54
II. Inter node	...	100	50	3.33	8.96	13.50	1.94	100	100	5.5	8.72	19.57	3.04
III. Inter node	...	100	20	3.0	6.0	1.66	0.33	100	33	3.0	4.3	6.67	0.67
IV. Inter node	...	100	20	8.0	5.5	9.38	1.18	100	67	1.0	Nil	...	...
12. Control — dipped in water													
I. Inter node	...	100	83	3.67	5.74	8.44	3.01	100	80	5.5	7.70	11.03	2.05
II. Inter node	...	80	80	5.78	5.77	13.50	2.95	100	75	4.5	4.40	2.39	0.41
III. Inter node	...	100	60	R	R	...	...	100	50	2.5	3.25	6.88	0.50
IV. Inter node	...	100	50	R	R	...	...	100	33	1.0	Nil	...	...

C—Callus formed

R—Rudimentary roots

It will be seen from the data collected that in the 1st, 2nd and 3rd internodes (from top) the use of growth promoting aids prove efficient for 12 hours treatment. The treatment for 24 hours combined higher percentages of success and greater root formation in all the internodes including the 4th. The effect on the more woody internodes was marked in the case of A (Auxin), the combination of C+N+A, potassium permanganate, cane sugar and urine extract solution. Phosphate treatment was associated with good production of thin and fine roots in both the treatments. With auxin, the main roots were thicker while branches were fewer. A combination of C+N+A was found to be a good allround treatment capable of stimulating root production even in the 4th woody internode. Twenty-four hours treatment of C+N+A appears to be comparatively more efficient.

TABLE XL.—Results of experiment on the vegetative propagation of coffee. Series II. Synthetic Hormones

Sl. No.	T R E A T M E N T	12 HOURS DURATION				24 HOURS DURATION				Average No. of length of main branch roots cm.				Average No. of length of main branch roots cm.			
		Percent living rooted		Average No. of length of main branch roots cm.		Percent living rooted		Average No. of length of main branch roots cm.		Percent rooted		Average No. of length of main branch roots cm.		Percent rooted		Average No. of length of main branch roots cm.	
		3	4	5	6	7	8	9	10	11	12	13	14	12	13	14	
1	2																
1.	N.A. 5—Naphthalene acetic acid 5 parts per million																
	I. Inter node	...	100	80	3.75	10.9	16.49	3.16	80	60	3.3	10.97	30.89	3.52			
	II. Inter node	...	100	75	3.0	11.9	33.12	3.2	100	67	2.4	4.0	3.00	0.36			
	III. Inter node	...	100	75	3.0	7.1	24.57	2.70	67	33	R	...	...	...			
	IV. Inter node	...	100	33	R	...	...	...	50	17	5.0	5.4	12.8	0.8			
2.	N.A. 25 — Naphthalene acetic acid. 25 parts per million																
	I. Inter node	...	100	75	2.75	6.97	14.3	2.57	50	50	4.33	12.30	12.25	2.57			
	II. Inter node	...	100	67	4.75	4.83	9.18	1.60	100	100	4.55	7.91	19.26	1.64			
	III. Inter node	...	100	57	4.25	5.65	15.43	2.45	67	67	1.0	R	...	...			
	IV. Inter node	...	80	20	R	...	...	...	67	67	2.5	2.50	6.0	0.69			
3.	N.A. 100 — Naphthalene acetic acid. 100 parts per million																
	I. Inter node	...	75	75	8	8.4	10.62	2.37	50	50	3.0	8.03	13.44	2.64			
	II. Inter node	...	100	67	C	C	C	C	100	100	4.0	6.2	9.37	1.57			
	III. Inter node	...	100	100	8.0	8.6	18.66	2.41	100	100	3.0	8.7	21.67	3.50			
	IV. Inter node	...	100	C	...	...	...	...	80	80	4.6	8.80	8.49	1.83			
4.	N.A. 200 — Naphthalene acetic acid. 200 parts per million																
	I. Inter node	...	100	100	5.0	5.28	10.55	2.2	67	67	9.0	8.3	6.67	1.0			
	II. Inter node	...	75	75	6.0	5.67	11.1	3.38	50	50	4.0	8.53	9.77	1.41			
	III. Inter node	...	100	40	4.0	9.0	13.14	1.57	100	67	R	...	...	...			
	IV. Inter node	...	100	67	4.0	7.9	10.9	1.13	40	40	2.0	14.0	22.5	1.5			

1	2	3	4	5	6	7	8	9	10	11	12	13	14
5. I.A. 5. B—indolyl acetic acid. 5 parts per million													
I. Inter node	...	67	67	4.5	7.0	16.52	2.3	50	50	4.0	6.8	26.25	1.62
II. Inter node	...	100	75	4.5	10.4	27.08	2.85	80	60	5.33	5.93	17.89	1.19
III. Inter node	...	75	75	1.66	14.15	22.5	2.5	40	40	1.0	...	...	...
IV. Inter node	...	50	50	R	...	...	...	50	50	R	...	...	...
6. I.A. 25. B—indolyl acetic acid. 25 parts per million													
I. Inter node	...	100	100	5.3	6.2	11.9	1.8	100	75	3.0	14.7	13.0	4.0
II. Inter node	...	86	57	2.33	5.12	25.0	4.33	80	67	7.5	6.0	13.31	0.80
III. Inter node	...	75	50	R	...	...	...	50	50	R	...	...	...
IV. Inter node	...	67	C	...	...	...	...	100	50	R	...	...	...
7. I.A. 100. B—indolyl acetic acid. 100 parts per million													
I. Inter node	...	100	100	6.0	5.5	7.31	1.17	67	50	5.33	8.10	22.27	1.73
II. Inter node	...	57	43	5.67	4.77	11.06	1.44	40	40	5.0	5.2	16.0	1.5
III. Inter node	...	100	75	5.67	7.87	37.67	2.96	75	50	5.5	9.45	24.0	1.9
IV. Inter node	...	60	40	4.0	...	...	...	67	33	...	...	...	...
8. I.A. 200. B—indolyl acetic acid. 200 parts per million													
I. Inter node	...	50	50	5.5	5.45	8.83	1.95	75	50	3.0	5.25	16.25	2.62
II. Inter node	...	71	57	6.0	6.3	10.83	2.4	100	50	4.0	9.08	17.00	1.93
III. Inter node	...	100	50	4.0	8.3	22.5	2.5	100	33	2.0	2.0	2.5	0.25
IV. Inter node	...	100	C	...	...	...	...	Nil	Nil	...	...	...	...
9. I.B. 5. B—indolyl butric acid. 5 parts per million													
I. Inter node	...	100	100	4.5	5.13	21.12	2.47	100	80	4.0	8.98	12.8	2.29
II. Inter node	...	100	75	2.66	7.4	18.33	3.36	100	100	C	R	...	...
III. Inter node	...	67	67	3.0	5.37	16.25	2.25	67	67	R	...	...	...
IV. Inter node	...	100	C	...	...	...	...	50	25	R	R	...	...

1	2	3	4	5	6	7	8	9	10	11	12	13	14
10. I.B. 25. B—indolyl butyric acid 25 parts per million													
I. Inter node	...	100	100	1.67	11.0	13.75	2.33	100	75	3.75	6.55	20.30	1.82
II. Inter node	...	100	100	5.0	6.4	13.53	1.94	100	80	4.25	11.72	20.83	1.73
III. Inter node	...	83	63	3.75	3.7	15.5	2.82	100	100	3.0	9.17	21.67	1.74
IV. Inter node	...	67	50	R	...	...	...	75	25	3.0	6.3	15.0	0.5
11. I.B. 100. B—indolyl butyric acid 100 parts per million													
I. Inter node	...	100	100	3.67	8.77	25.69	2.61	60	60	4.0	7.5	11.25	1.62
II. Inter node	...	67	67	4.67	7.53	18.41	2.43	83	50	2.33	7.76	19.17	0.72
III. Inter node	...	100	60	7.67	10.73	28.1	2.3	100	40	3.5	11.25	24.9	2.19
IV. Inter node	...	100	67	3.5	4.05	7.00	0.95	67	67	2.5	5.00	11.25	0.94
12. I.B. 200. B—indolyl butyric acid 200 parts per million													
I. Inter node	...	100	100	3.0	9.0	22.48	3.17	67	67	3.0	5.25	10.8	0.57
II. Inter node	...	100	100	6.67	10.0	28.02	3.03	100	67	6.5	8.80	16.43	1.84
III. Inter node	...	67	67	6.0	8.4	15.41	1.91	100	67	C	...	...	...
IV. Inter node	...	50	50	...	...	...	...	100	33	R	...	...	...
13. P.A. 5. 2-4 Dichlorophenoxy acetic acid 5 parts per million													
I. Inter node	...	100	100	3.5	10.2	17.98	2.36	100	100	5.0	6.8	10.12	4.45
II. Inter node	...	100	67	5.2	7.5	11.33	2.21	80	80	1.0	R	...	...
III. Inter node	...	100	60	5.67	9.0	14.72	2.31	83	67	4.25	5.0	8.39	1.02
IV. Inter node	...	100	C	...	...	...	...	67	67	3.5	4.72	1.25	0.12
14. P.A. 25. 2-4 Dichlorophenoxy acetic acid 25 parts per million													
I. Inter node	...	100	16	6.0	4.9	5.83	1.33	Nil	Nil	...	9.62	...	...
II. Inter node	...	50	50	6.0	3.8	1.66	0.67	100	100	6.75	...	16.49	1.84
III. Inter node	...	50	50	5.0	8.0	13.5	12.75	Nil	Nil	...	...	...	...
IV. Inter node	...	100	33	2.0	5.0	6.67	1.0	100	33	2.0	2.0	3.33	0.67

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15. P.A. 100. 2-4 Dichlorophenoxy acetic acid 100 parts per million													
I. Inter node	...	...	16	8.0	8.5	1.75	...	Nil	Nil	...	...	...	...
II. Inter node	...	67	...	...	...	...	0.25	Nil	Nil	...	...	...	...
III. Inter node	...	100	C	...	...	...	...	Nil	Nil	...	...	...	...
IV. Inter node	...	20	C	...	...	...	...	Nil	Nil	...	...	...	...
16. P.A. 200. 2-4 Dichlorophenoxy acetic acid													
I. Inter node	...	67	C	...	...	13.33	...	Nil	Nil	...	...	...	...
II. Inter node	...	29	14	4.0	7.0	...	1.33	Nil	Nil	...	...	...	...
III. Inter node	...	Nil	Nil	...	...	...	...	Nil	Nil	...	...	...	...
IV. Inter node	...	Nil	Nil	...	...	...	...	Nil	Nil	...	...	...	...
17. U.E.D. Urine extract dipped													
I. Inter node	...	100	100	1.8	4.2	15.00	3.00	88	88	2.43	7.77	15.48	4.03
II. Inter node	...	80	80	R	R	...	...	100	50	5.67	9.05	19.75	1.86
III. Inter node	...	67	33	R	R	...	...	75	75	2.4	3.20	7.33	0.67
IV. Inter node	...	67	33	7.0	9.7	10.5	1.42	80	C	...	...	...	...
18. Control. Dipped in water													
I. Inter node	...	50	50	1.5	5.0	10.0	1.5	50	25	6.0	5.3	10.33	1.16
II. Inter node	...	80	40	1.5	4.0	15.83	2.0	100	67	3.5	9.5	13.33	1.66
III. Inter node	...	50	50	3.5	8.25	9.2	2.04	67	67	3.0	1.36	14.28	2.15
IV. Inter node	...	100	50	1.0	3.1	5.0	1.0	50	C	...	...	...	...

C—Callus formed

R—Rudimentary roots

Auxin treatment for twelve hours was found to be definitely superior to twenty-four hours treatment. Concentration of 5 and 25 parts per million were comparatively poorer in effect while 100 parts per million are nearer the optimum in all cases except in the case of dichloro-phenoxy-acetic acid. In the latter case 5 parts per million was found to be best while the cuttings tolerated 25 parts in the 12 hours treatment. In the case of Indolyl—butyric acid though the roots were thinner compared to other treatments, the number of roots were more with profuse secondaries and tertiaries.

One common observation in both the series was that the first and second internodes started rooting earlier—within a month after planting. The above observations indicate that it is not desirable to allow the suckers to grow beyond the 4th internode for getting cuttings for quicker root formation. The above are interesting observations and it is proposed to continue the studies further.

D. PLANT PROTECTION

A. Plant diseases

50. Following were the items of work done during the year—

- (i) Time and strength of Bordeaux spray.
- (ii) Trials with lower strengths of Bordeaux than 2-2-40.
- (iii) Relative merits of various copper fungicides with wetters and spreaders.
- (iv) The use of 'teepol' as a spreader for Bordeaux mixture.
- (v) Comparison of 'albolineum' with 'teepol' as a spreader for Bordeaux mixture.
- (vi) Comparison of Bordeaux mixture with *copper sandoz*.

51. **Time and strength of Bordeaux spray.** This experiment which was begun in 1944 was continued. The experiment was located in 3 places in Coorg viz. Kirgandur (N. Coorg), Luxmi (Central Coorg) and Ghattedhalla (S. Coorg). The efficiency of the treatments was evaluated in terms of (1) effective leaf survival and (2) resultant yields of ripe cherry. The merits of the main and sub-treatments were found to vary from season to season. The results are given below—

<i>Locality</i>: Coorg (3 zones) <i>Year</i>. 1951-52 <i>Variety</i>: Arabica (Coorgs) <i>Shade</i>: Natural shade. <i>Treatments</i>: Main = 3, Sub. = 2.	<i>Layout</i>: Split plot design. <i>Size of plot</i>: Gross 6 x 16 trees Nett 4 x 16 ,, <i>Main replications</i>: 6
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TABLE XLI—Percentage of leaf survival and Yields in relation to time, strength and zone

TREATMENTS	EFFECTIVE % OF LEAF SURVIVAL			YIELD PER ACRE 1952	
	Feb. 1951	Sept. 1951	Feb. 1952	Ripe Cherry lb.	Coffee cwt.
<i>Main treatments:</i>					
A. Pre-monsoon	... 23.4	61.2	26.9	1509	2.25
B. Pre-and Post	... 23.9	61.8	25.5	1982	2.95
C. Post-monsoon	... 24.9	53.9	25.7	1185	1.76
Mean	... 24.1	60.1	26.1	1558	2.32
S.E.M. %	... 1.72	1.70	2.26	7.99	
Sig. or not.	... Yes.	Yes.	No.	Yes.	
Crit. difference	... 1.2	2.9	1.7	361	0.54
Conclusions	... C, B, A	B, A, C	A, C, B	B, A, C	
<i>Sub-treatments:</i>					
E. Bordeaux 4-4-40	... 23.8	59.8	26.1	1554	2.31
F. " 2-2-40	... 24.3	60.1	26.0	1564	2.33
Mean	... 24.1	60.0	26.1	1558	2.32
S.E.M. %	... 1.27	1.06	1.45	4.42	
Sig. or not	... No.	No.	No.	No.	
Crit. difference	... 0.9	1.8	1.1	197	0.29
Conclusions	... F E	E F	E F	F E	
<i>Zones:</i>					
K. Kirgandur	... 25.7	67.3	23.4	1380	2.05
L. Luxmi	... 25.9	54.8	30.8	1084	1.61
G. Ghattedhalla	... 20.7	57.7	24.0	2214	3.29
Mean	... 24.1	60.0	26.1	1558	2.32
S.E.M. %	... 1.72	1.70	2.26	7.99	
Sig. or not	... Yes.	Yes.	Yes.	Yes.	
Crit. difference	... 1.2	2.9	1.7	361	0.54
Conclusions	... L, K, G	K, G, L	L, G, K	G, K, L	

*Significant Interactions :**Time X Strength—(Feb. 1951 Leaf counts)*

		A.	B.	C.	Conclusions	
E.	...	22.5	23.5	25.5	$\overline{C,B,A}$	Std. error = 2.20
F.	...	24.4	24.2	24.4	$\overline{A,C,B}$	Cr. diff. = 1.5
Conclusions	...	$\overline{F,E}$	$\overline{F,E}$	$\overline{E,F}$		

*Significant Interactions**Locality X Time X Strength—(Sept. 51 Leaf counts)*

			Kirgandur	Luxmi	Ghattad hulla	Conclu- sions	
A.	E	...	70.1	53.8	61.7	$\overline{K,G,L}$	% Std. Error = 3.17
	F	...	68.7 $\overline{E,F}$	55.7 $\overline{F,E}$	57.0 $\overline{E,F}$	$\overline{K,G,L}$	C.D. = 13.3
B.	E	...	66.5	59.5	61.0	$\overline{K,G,L}$	
	F	...	72.3 $\overline{F,E}$	51.0 $\overline{E,F}$	60.5 $\overline{E,F}$	$\overline{K,G,L}$	
C.	E	...	61.9	51.8	52.3	$\overline{K,G,L}$	
	F	...	64.5 $\overline{F,E}$	57.0 $\overline{F,E}$	54.2 $\overline{F,E}$	$\overline{K,L,G}$	

*Significant Interactions**Locality X Time (Feb. 52 Leaf counts)*

		A.	B.	C.	Conclusions	
K.	..	23.2	23.2	23.8	$\overline{C,B,A}$	Std. error = 3.91
L.	...	33.6	30.7	28.1	$\overline{A,B,C}$	C.D. = 3.0
G.	...	24.0	22.7	25.2	$\overline{C,A,B}$	
Conclusions	...	$\overline{L,G,K}$	$\overline{L,K,G}$	$\overline{L,G,K}$		

*Significant Interactions**Strength X Time—(Feb. 52 leaf counts)*

		E.	F.	Conclusions	
A.	...	26.1	27.8	$\overline{F,E}$	% Std. Error = 2.51
B.	...	26.4	24.6	$\overline{E,F}$	C.D. = 1.9
C.	...	25.9	25.6	$\overline{E,F}$	
Conclusions	...	$\overline{B,A,C}$	$\overline{A,C,B}$		

*Significant Interactions**Time X—Locality (Yield 1952)*

		<i>A.</i>	<i>B.</i>	<i>C.</i>	<i>Conclusions</i>	
<i>K.</i>	...	1099	1740	1299		
		1.64	2.59	1.93	<u>B,C,A</u>	Std. error=13.83
<i>L.</i>	...	1149	1183	705		
		1.71	1.76	1.05	<u>B,A,C</u>	C.D.=625 lb. or
<i>G.</i>	...	2278	3026	1337		0.93 cwt.
		3.39	4.50	1.99	<u>B,A,C</u>	
		<u>G,L,K</u>	<u>G,K,L</u>	<u>G,K,L</u>		

Leaf counts : Main treatments—Timing.

Feb. 1951. Post-monsoon treatment has more leaf than pre-monsoon.

Sep. 1951. *Pre* only and *Pre* + *Post* monsoon treatments are better than *Post* only.

Feb. 52. No difference among treatments.

Sub-Treatments—Strength:

No difference between 4-4-40 and 2-2-40 in any of the leaf counts.

Zone: The leaf retention among the different zones are significant, but varies from season to season.

Interactions—Influence of time on strength.

Feb. 1951. It appears that higher strength may have some beneficial effect in post-monsoon spray only.

Interaction—Influence of zone on time and strength.

Sometimes Kirgandur is better than Luxmi in Premonsoon at 4-4-40, but is so when double-sprayed at 2-2-40.

Feb. 1952. *Zone & Time*—Leaf retention according to different times of spray is influenced by the *Zone*.

Time & strength. Though significant, does not convey any rationale.

Yield. Times—Double spray is better than *pre* monsoon spray only which again is better than *post* monsoon spray only.

Strength. No difference between 4-4-40 and 2-2-40.

Time x Zone. The efficacy of the times of spray is dependant to a large extent on *Zones*.

Zones. Ghattedhulla has more yield than either Kirgandur or Luxmi.

52. Trials with lower strengths of Bordeaux spray (Mysore)

An experiment was started in June 1951 at Balehonnur to compare the effects of 3 different strengths of Bordeaux mixture. The object of the experiment is to find out if lower strengths of Bordeaux than 2-2-40 could give efficient control of leaf disease with two sprayings. In the same experiment, a bye-product of an industry, obtained from M/s Parry & Co. Ltd., said to contain 80 per cent of copper sulphate, 10 per cent of nickel sulphate, 10 per cent of zinc sulphate and 1 per cent free sulphuric acid was used as the fourth variant. A three-fold replication was adopted. For analysis each main plot was split up into two with two rows for each sub-plot and the yields recorded. The results are as follows—

Locality: Balehonnur (Mysore)

Year: 1951-52

Layout: Randomized blocks & replicated 3 times

Variety: Kents.

Treatments: 4

Area of each plot: Gross 16 x 6 plant points.

Nett 14 x 4 „ „ or) *Spacing:* 5' x 5'.

3.21 cent)

Sub-plot: Nett 2 x 14 (28 plant points) or 1.61 cents.

53. **Relative merits of various copper fungicides with wetters and spreaders.** An experiment to compare the relative merits of copper fungicides, wetters and spreaders now on the market, with plain Bordeaux as Control was started in June 1951. The variety of coffee taken for the experiment was *Coorgs* about 40 years old. The yields from the first harvest and the mean percentage of leaf infection are given in the table.

Locality : Balehonnur (Mysore) *Year* : 1951-52.
Layout : Randomized blocks *Treatments* : 12.
 replicated 4 times.

Area of each plot : $\begin{array}{l} \text{Gross}-15 \times 8 = 120 \text{ plant points} \\ \text{Nett}-13 \times 6 \quad 78 \quad \text{do} \\ \text{or } 4.48 \text{ cents.} \end{array} \left. \vphantom{\begin{array}{l} \text{Gross}-15 \times 8 = 120 \text{ plant points} \\ \text{Nett}-13 \times 6 \quad 78 \quad \text{do} \\ \text{or } 4.48 \text{ cents.} \end{array}} \right\} \text{Spacing, } 5' \times 5'$

Time of application of spray: (i) Early in June—pre-monsoon.
(ii) Early in Oct.—Post monsoon.

TABLE XLIII—Summary of September–October leaf counts and yields

TREATMENTS	Healthy leaves	With stray disease spots	Yield of ripe cherry in lb. and cwt. of clean in cwt. per acre	
			Ripe Cherry	Clean coffee
A. Bordeaux 2-2-40	... 25.8	27.1	2224	3.71
B. —do— + 1½ Teepol in 40 gals	... 24.7	14.2	3093	5.16
C. —do— + 1½ Lissapol —do—	... 21.7	17.7	2641	4.41
D. —do— + 1 oz. Agral II —do—	... 22.0	13.1	2197	3.61
E. —do— + 1 oz. Agral LN—do—	... 30.1	17.3	2603	4.35
F. —do— + 7½ oz. Corvus oil do	... 33.0	11.3	2470	4.13
G. —do— + 6 oz. Stanvac detergent.	... 28.9	18.3	2523	4.21
H. —do— + 6 oz. Shell Foliol	... 43.5	30.7	2442	4.08
I. Copper sandoz 1 lb. plus 1½ oz. Lissapol in 40 gals	... 25.5	13.3	2412	4.03
J. Petenox 1 lb. + 1½ oz. Lissapol in 40 gals	... 24.5	19.0	2639	4.41
K. Cuprocide 10 oz. + 1½ oz. Lissapol in 40 gals	... 25.0	11.8	2587	4.32
L. Shell copper fungicide 1 lb. + 10 oz. Arkotone in 40 gallons	... 24.4	7.4	2362	3.94
Mean	...		2516	4.20
Critical difference	...			1.75
S.E.M. %	...			14.98
Conclusions	...			All equal

It is found that the yields do not show any significant difference. In evaluating the degree of leaf disease incidence, a more detailed method was adopted for assay of the data according to the degree of infection. Records taken in September 1951 however do not show consistent relation with yields.

54. **Use of Teepol as a 'spreader'.** The experiment in Coorg with different strengths of Teepol was continued.

Locality: Ghattedhulla (Coorg) Layout: Randomized block 4 × 6.
 Size of plot: Gross 4 × 30
 Nett 3 × 30.

Treatments:

- A. Bordeaux 2-2-40.
 B. —do— + ¾ oz. Teepol per 40 gals.
 C. —do— + 1½ oz. —do— —do—
 D. —do— + 3 oz. —do— —do—

TABLE XLIV—Leaf counts and yield records

TREATMENTS	LEAF COUNTS			YIELD PER ACRE	
	Feb. 51	Sept. 51	Feb. 52	Ripe cherry lb.	Clean coffee cwt.
A.	... 21.2	60.3	24.6	4236	6.30
B.	... 22.8	58.7	24.1	4672	6.95
C.	... 23.6	57.5	24.8	4016	5.98
D.	... 22.5	59.1	24.4	4600	6.85
Gen. mean	... 22.5	58.9	24.5	4380	6.52
Standard error	... 8.46	2.86	4.09	17.15	
Sig. or not	... No	No	No	No	
Crit. difference	... 5.7	5.1	3.0	2250	3.36
Conclusions	... C,B,D,A	A,D,B,C	C,A,D,B	B,D,A,C	

As per leaf counts this year, the addition of Teepol has not materially

affected leaf position as during the last season. Even the yield differences between the different treatments are not statistically significant.

55. **Comparison of Albolineum with Teepol as a spreader :**

Locality: Ghattedhulla (Coorg) *Layout:* Randomized blocks 3 × 6

Treatments:

- A. Bordeaux 2-2-40.
 B. —do— + 1 oz. Teepol per 40 gallons.
 C. —do— + 2 oz. Albolineum —do—

TABLE XLV—Results of Teepol and Albolineum as spreaders

TREATMENTS	LEAF COUNTS			YIELD PER ACRE		
	Feb. 51	Sept. 51	Feb. 52	Ripe cherry lb.	Clean coffee cwt.	
A.	...	15.2	57.3	24.8	2856	4.25
B.	...	15.9	60.7	25.3	3200	4.76
C.	...	17.2	62.4	26.2	2860	4.26
Mean	...	16.1	60.2	25.5	2980	4.43
Std. error	...	4.61	6.95	4.05	10.85	
Sig. or not	...	No	No	No	No	
Crt. Difference	...	6.9	13.2	3.3	1042	1.55
Conclusions	...	C,B,A	C,B,A	C,B,A	B,C,A	

Neither the data for leaf survivals nor that for yields are significant.

56. **Comparison of Bordeaux mixture with Copper sandoz.** This experiment was started in Chethalli during October 1951 to compare the proprietary product Copper Sandoz with Bordeaux mixture. The results are given below :—

Layout: Randomized block 4 × 5

Treatments:

- A. Control (no spraying).
 B. Bordeaux mixture 2-2-40.
 C. Cooper sandoz 2 lb. in 40 gallons.
 D. Copper sandoz 1 lb. in 40 gallons.

TABLE XLVI—Comparison of Bordeaux with Copper sandoz

TREATMENTS	LEAF COUNTS			YIELD PER ACRE		
	Feb. 51	Sept. 51	Feb. 52	Fruit lb.	Clean coffee cwt.	
A. Control	...	23.0	62.7	22.3	501	0.75
B. Bordeaux 2-2-40	...	20.9	68.6	29.0	1586	2.36
C. Copper sandoz 2 lb. in 40 gals	...	20.8	72.1	27.0	1170	1.74
D. Copper sandoz 1 lb. in 40 gals	...	21.5	70.8	27.2	973	1.45
Mean	...	21.5	68.6	26.9	1057	1.57
Sig. or not	...	No.	No.	No.	Yes.	
S.E.M. %	...	5.09	3.53	5.85	17.45	
Crit. difference	...	3.4	7.5	4.8	569	0.85
Conclusions	...	A,D,B,C	C,D,B,A	B,D,C,A	B,C,D,A	

The differences in leaf counts are not significant. In yield plain Bordeaux

is better than control and copper sandoz, 1 lb. in 40 gallons. Copper sandoz 2 lb. in 40 gallons is better than control.

B. Coffee Pests

57. White stem borer of coffee (*Xylotrechus quadripes* Chev.)

(a) Two sets of experiments started in October 1949 for the control of borers were continued. The treatments consisted of 1 per cent D.D.T. formulation, 1 per cent B.H.C. in the form of Gammexane P. 520 and Control.

D.D.T.	B.H.C.
70-80% Technical = $5\frac{1}{2}$ lb.	50% B.H.C. to contain 6.4%
Gum arabic = 3 oz.	Gama-isomer = 8 lb.
Gelatine = $1\frac{1}{2}$ oz.	Water = 40 gals.
Water = 40 gallons.	

Several rounds of borer infested trees were removed during the year prior to each of the flight seasons, viz. April-May and October-December, and burnt. The data are given in the table below:—

TABLE XLVII—Borer control with chemicals

PARTICULARS	D.D.T	B.H.C.	CONTROL
<i>Coffee Research sub-station, Chethalli</i>			
Total trees at the commencement of the experiment ...	1109	1074	1061
Number of bored trees removed upto 30-6-1951 ...	298	239	314
Percentage of removals ...	26.9	22.3	29.6
Balance of plants under treatment on 1-7-1951 ...	811	385	741
No. of bored trees removed from 1-7-1951 to 16-5-1952.	43	51	59
Percentage of removals ...	5.3	6.1	7.9
Balance of plants on 17-5-52 ...	768	784	688
Bored trees removed from 17-5-52 to 12-7-1952 ...	20	11	50
Percentage of removals ...	2.6	1.4	7.3
<i>Biccode Estate, Biccode (Mysore)</i>			
Total trees at the commencement of the experiment ...	1540	1663	1542
Bored trees removed upto 12-7-51 ...	302	268	572
Percentage of removals ...	19.6	17.1	37.0
Balance trees under treatment on 13-7-51 ...	1238	1295	970
Bored trees removed from 13-7-51 to 15-7-52 ...	16	12	33
Percentage of removals ...	1.3	0.9	3.4
Balance of trees under treatment on 16-7-52 ...	1222	1283	937
No. of trees removed on 16-7-52 ...	9	6	26
Percentage of removals ...	0.7	0.5	2.8

It will be noticed from the above figures that the incidence of infection has come down remarkably since July 1951. It is also to be remembered that the results of a small-scale experiment in a heavily infested area like Chethalli would be vitiated by the surrounding sources of infection.*

* Since this report was written up I have received reports from two private planters about their experiences of B.H.C. treatments. One in S. Mysore states that he treated his whole estate at 3.7 lb. of 'Agroicide P. 520' per acre and reduced his average incidence during the previous 10 years from 99 per acre to 15 acre. His overall cost per treatment works out at Rs. 9.8 per acre. (Another planter from a different area in Mysore states that he used on an average 3 lb. of 'Agroicide P. 520' per acre per treatment costing about Rs. 5.2 for the Agroicide and Rs. 2.7 for the labour per round. It is understood that several planters are applying this preparation to their coffee areas this season.

(b) In another experiment started in a neighbouring estate of the Coffee Research Station—Balehonnur the following treatments were tried. (1) per cent B. H. C. in water, (2) D. D. T. 2 per cent water suspension, (3) a mixture of gammexane and D.D.T. in water, (4) Acrodel in two strengths of 0.1 and 0.2 per centages and (5) Gammexane in oil in two strengths. The treatment of Gammexane in oil somewhat affected the coffee bushes during the dry weather. The experiment was abandoned and its venue changed to the Coffee Research Station.

Control of green bug (*Lecanium viride* G.):

58. In recent years, green bug (*Lecanium viride* G.) on arabica coffee has become a major pest in the predominantly N.E. monsoon areas. Though it occurs to a smaller extent in other coffee growing tracts also, the Eastern slopes of the Nilgiris and the whole of Shevaroys have suffered extensively due to the successively poor N.E. monsoons during the past five seasons followed by long periods of rainless months. In normal years sporadic outbreaks were common during hot weather but were usually checked by the activity of the entomophagous fungus (*Empusa lecanii* Zimm.) when rains set in. Absence of favourable humid conditions had of late reduced the spread of this beneficial fungus. As a result, the infestation of green bug has been continuously on the increase impairing the vitality of the coffee bushes and reducing the yields. On the S.W. monsoon regions also the pest has been noted to infest coffee in the new clearings particularly during the dry weather. It is however kept in check with the spread of the entomophagous white fungus (*Cephalosporium lecanii* Zimm.) during the S.W. monsoon. Three sets of experiments were therefore started, the first at three estates in the Eastern Nilgiris (Marvahulla, Arcōod and Moutere), the second on Merthi-khan (N. Mysore) and the third at Maryland (Shevaroys).

Experiments at Nilgiris:

59. In the two places—Arcōod and Moutere—only one round of spraying was done while at Marvahulla two rounds of spraying were done, the first early in September and the second a fortnight later. Observations in these places were mainly recorded by the Superintendents of the respective estates. From leaf samples received from Arcōod, it was observed that 2% Fish-oil-rosin soap with 9 oz. of caustic soda was found to give the maximum kill followed by Parathion 0.05%. Albolineum 1½% and Derri-phytan 0.5% were found to be no better than the Control. At Moutere only 3 treatments were attempted and these were carried out once only on 4-9-1951. These were (1) Fish-oil-rosin soap 2% (with ½% soda ash), (2) Parathion in the form of Ekatox-5 at 200 gms. in 40 gallons of water and (3) Control. Other items proposed viz. Albolineum 1½% and Marylands mixture were not carried out. At Marvahulla, the treatments were:—

- (i) Fish-oil rosin soap 2% (with ½% soda ash).
 - (ii) Albolineum 1½%.
 - (iii) Control (No treatment).
 - (iv) Parathion (Tetrax) 0.05%.
- and (v) Maryland's mixture (Phynazol 8 oz. + Soft soap 6 lb. + Light diesel oil 4 gals.)

All the treatments except Maryland's mixture were administered on 1-9-1951. About the middle of September the second round of treatments were administered when the strength of Parathion was doubled. From the reports received from the Manager of the Estate it was found that Parathion is outstanding with Maryland's mixture closely following. Fish-oil-rosin soap and Albolineum came next in order.

60. The Manager of Marvahulla estate (Mr. C. Primrose), however, started an experiment on his own on 3rd October 1951. The second spraying was done 13 days later on the 16th October. His findings were published in

Indian Coffee for March 1952. The order of efficacy of the five treatments he carried out was as follows :—

TREATMENT	STRENGTH	Cost of mixture per spray			Cost of labour			Total cost per acre per round		
		Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
1. H.E.T.P.	0.25% (1 lb. in 40 gals)	46	1	0	14	10	0	60	11	0
2. Fish-oil-rosin soap	1½ % (6 lb. in 40 gals) + 7 lb. rosin + 3½ oz. washing soda	108	3	0	16	14	0	125	1	0
3. Albolineum No. 2	1½ % (6 lb. in 40 gals)	99	0	0	14	10	0	113	10	0
4. Parathion (Tetrax)	Ruled out as dangerously poisonous.									
5. Maryland's mixture		44	11	0	16	14	0	61	9	0

Note :— The cost was calculated on 440 gallons of spray liquid per acre per application.

61. Further experiments at Moutere. In April-May 1952, two sets of trials were conducted at Moutere in which two rounds of sprayings were done. The first round of treatments was completed between 30-4-1952 1-5-1952 and the second round was done on 9-5-1952. No counts of infestation before the treatments was done. But counts were taken from the fourth day of the first application and a week after the second application. From each plot, the youngest adult leaf collected from one or two shoots having very heavy infection was examined at the proximal end of a leaf-blade under a magnifying glass. Twenty leaves were examined for each plot and the figures of adults and nymphs were calculated for 100 leaves. All numbers upto 20 were counted and figures above this number were given the maximum value of 20. As figures pertaining to different treatments were widely varying, the data were transformed to their corresponding logarithmic figures and statistically analysed. The results are furnished below :—

Locality : Moutere estate (Nilgiris)
Plot size : *Nett.* One fow of 12 plants.
Guard rows : One between 2 treatments.
Replications : 3.
Treatments : 5 (as below).

EXPERIMENT I

A.	Fish-oil-rosin soap	8 lb.
	Caustic soda	9 oz.
	Water	40 galls.
B.	Albolineum	7 lb.
	Water	40 galls.
C.	Control (no treatment)	
D.	H.E.T.P. (0.1%)	6.4 oz.
	Water	40 galls.
E.	Maryland's mixture	
	Phynazol	8 oz.
	Soft soap	6 lb.
	Light diesel oil	4 galls.

EXPERIMENT II

L.	Control (no treatment)	
M.	H.E.T.P. (0.1%)	6.4 oz.
	Water	40 galls.
N.	Fish-oil-rosin soap	8 lb.
	Soda ash	2 lb.
	Water	40 galls.
O.	Fish-oil-rosin soap	8 lb.
	Rosin	4 lb.
	Soda Ash	2 lb.
	Water	40 galls.
P.	Parathion (Ekatox-20)	
	0.1%	6.4 oz.
	Water	40 galls.

**TABLE XLVIII—Results of treatments against green bug.
(Moutere estate)**

TREATMENTS	Population counts transformed to logarithmic figures		TREATMENT	Population counts transformed to logarithmic figures	
	Adults	Nymphs		Adults	Nymphs
<i>EXPERIMENT I</i>			<i>EXPERIMENT II</i>		
A. ...	2.2978	2.0976	L. ...	2.7830	2.9365
B. ...	2.4056	2.6547	M. ...	1.7597	1.4144
C. ...	2.9213	3.1440	N. ...	2.3501	2.4616
D. ...	1.8206	1.4758	O. ...	2.1661	2.3044
E. ...	2.7711	3.0016	P. ...	1.9521	2.0666
Mean ...	2.4433	2.4748	Mean ...	2.2022	2.2367
Std. error ...	2.33	3.87	Std. error ...	5.47	7.36
Cr. diff. ...	0.1709	0.1817	Cr. diff. ...	0.6805	0.5249
Conclusion ...	C,E, B,A,D	C,E,B,A,D		L,N,O,P,M	L,N,O,P,M

In the first experiment, H.E.T.P. gave the best kill but its superiority is not well defined in the second experiment. Albolineum was only as good as fish-oil-rosin soap with soda ash though it was slightly more effective with nymphs. Maryland's mixture was the least promising and no better than control. Parathion (not included in the first experiment) was the next best to H.E.T.P. and almost similar in effect to the F.O.R. soap preparations.

62. Another series of experiment carried out were at Merthikhan estate (Mysore) and at Maryland estate on the Shevaroy's representing the S.W. and N.E. monsoon areas respectively.

63. **Experiment at Merthikhan.** Twenty seven treatments were tried at Merthikhan on 2-year old plants with contract, stomach and respiratory poisons containing active principles like D.D.T., D.D.D., Parathion, petroleum oil, insecticides of plant origin like Nicotine and Roteoñone, fish-oil and honge-oil rosin soaps. Only one spraying was done in April and observations of reinfestation recorded 1½ months later. The observations at this place were more of a qualitative nature.

64. **Experiments at Maryland estate (Shevaroy's).** Before spraying, counts were taken of infestation and it was found that the population on the leaves varied from 20 to 50 per cent adults while the rest were nymphs. The first spraying was done on 4th, 5th and 6th May 1952 and the second on 2nd, 3rd and 4th June 1952. Two days after spraying, leaves were sampled from branches that had good infestation. Three penultimate leaves thus sampled were taken per tree from two of the trees under each replication, as these were found more heavily infested than the younger leaves. Counts of dead and living insects were made on the mid-ribs on the under surface of the leaves and infestations per unit length were calculated. To test the reliability of such a method, counts of the insect population were taken on (1) the upper surface, (2) the lower surface and (3) the mid-ribs separately on 60 leaves collected at random prior to spraying. Correlation coefficient worked out between the total infestation and the counts in the mid-ribs gave the value of 0.77 which was significant even at 1 per cent level. For assessing the efficiency of the treatments, mortality counts recorded were averaged into percentages for easy comparison. The percentages were then transformed to their $\sin^2 e$ values as recommended for such disease infestations studies which are computed from varying populations from leaf to leaf. Analyses of values were worked out on the $\sin^2 e$ values. The table is furnished below :—

Locality : Marland estate (Shevaroy's).

Variants : As detailed in the table.

Layout : Randomized and replicated 4 times.

Variety : Coorgs over 30 years old.

Size of plots : 4 plants.

Date of applications : 1st application : 4th, 5th and 6th May 1952.

2nd application : 2nd, 3rd and 4th June 1952.

TABLE XLIX—Green bug control experiment (Maryland estate, hevaroy hills)—May to September 1952

Sym- bol	Insecticide applied. 1st Application 4, 5 and 6 May 1952 2nd Application 2, 3 and 4 June 1952	Strength used	Mean insect population per unit cm. on midrib of leaf before application	% of kill cor- rected value Sin ² e. Two days after first application	Mean insect population after 3 weeks per cm. length of midrib	% kill corrected value Sin ² e two days after second application	Mean insect population of midrib of leaf 3 mths after 2nd spray	Cost of mate- rials per acre
1	2	3	4	5	6	7	8	9
A.	Ekatox liquid lower dose	...	12.83	77.2	3.73	88.4	3.85	62 2 4
B.	—do— higher dose	...	9.69	85.0	0.77	90.0	1.94	124 4 8
C.	Ekatox wettable powder lower dose	...	16.25	80.8	3.58	72.7	4.59	21 11 7
D.	—do— —do— higher dose	...	15.50	81.5	2.49	76.9	1.82	43 7 2
E.	Geigy's liquid higher dose	...	11.69	37.8	High infestation-many living-low kill	—do—	8.95	
F.	Geigy's DDT powder	... 35 lb per acre	16.18	63.2	—do—	—do—	7.22	
G.	Ekatox dusting powder	...	12.97	49.9	4.53	77.5	3.05	103 6 6
H.	Sytam lower dose	...	10.05	64.6	3.95	69.6	2.57	
I.	—do— higher dose	...	8.10	74.1	1.59	80.5	2.34	
J.	BFPO lower dose	...	11.69	64.0	2.35	63.2	2.81	
K.	BFPO applied to roots (twice)	... (@ 1 pint per plant)	9.95	30.0	3.24	75.5	0.25	
K ₁ .	—do— (applied once at start)	...	9.95	30.0	3.24	...	0.44	
L.	Pestox lower dose	...	10.40	67.3	5.56	60.1	3.37	
M.	—do— higher dose	...	15.20	79.8	2.27	71.2	4.90	
N.	Tetraz	...	8.69	64.6	3.43	64.8	3.66	
O.	H.E.T.P.	...	14.66	83.0	0.76	87.6	1.54	42 8 0
	—do— (separate test)	...	*0.125%	Not done	10.34	81.9	2.01	21 4 0
P.	Arkotine	...	11.61	60.1	High infestation-many living-no good kill	—do—	4.32	
Q.	Euphytan summer	...	12.77	56.5	—do—	—do—	6.82	
R.	Deriphytan	...	11.42	58.2	—do—	—do—	7.95	
S.	Nicophytan	...	10.07	52.3	—do—	—do—	2.52	
T.	Albolenium with Agrocide 3	...	9.61	68.3	2.65	64.7	2.21	

1	2	3	4	5	6	7	8	9
U.	Fish oil rosin soap	...	9.71	65.0	2.56	86.7	2.57	107 4 0
V.	Honge oil rosin soap	...	10.58	73.9	2.65	87.9	3.01	95 12 0
W.	Control (no treatment)	...	13.91	6.9	10.64	16.9	4.38	
	Significant or not	...	No. (Z test not satisfied)	Yes	Yes	Yes	Yes	
	Critical difference	...	6.20	7.6	2.19	3.73	1.59	
	S.E.M. %	...	18.03	4.34	17.75	7.50	15.90	
	Conclusions	...	All equal	As in I	As in II	As in III	As in IV	

Conclusions:

I. BODCMAIVTLUNHJGPRQSFEKW

II. WLFHACNKTVDJMI BO

III. BAVOUIFDKCMHNTJLW

IV. ERFQMCWPANLGVJUHSTITBDOK₁K

From the results it is found that Ekatox 0.2% shows the greatest potency. H. E. T. P. higher and lower dose are next in efficacy. Ekatox wettable powder is nearly as good. Rebuilding of pest population was also comparatively lower on these treatments. These have proved better than fish-oil-rosin soap and honge-oil-rosin soap in the extent of kills effected. From the point of view of cost, H. E. T. P. (lower dose) is the best.

*0.125% found equally good in effect.

65. **Coffee eelworm (*Pratylenchus pratensis*)**. An experiment was started on the Dibidi Division of Coovercolly estate to try the relative merits of (1) Parathion, (2) D.D. and (3) Control. There were 5 replications which were arranged in the following order :—

- I. B A C
- II. C A B Size of plot : 3 rows of 3 Plants.
- III. C A B
- IV. B C A
- V. C B A

Treatments :

- A. Parathion—3·2 oz. in 40 gallons distributed by water cans.
- B. D. D. —Applied by the soil injector at the rate of 4 c.c. per injection at distances of 16 inches (25·9 gallons per acre).
- C. Control (no treatment).

The whole area was drenched with water to allow the soil injector to be pushed in.

66. Besides this, the use of Parathion spray was tried in the O.L. Division, Coovercolly as follows :—

- 1. Parathion 3·2 oz. per 40 gallons to be repeated every ten days.
- 2. Control (no treatment).

67. Another experiment was started at Chaudicadoo estate in the following lay-out :—

Size of plot : 3 rows of 3 trees.

Replications : 6.

Treatments : 4.

- 1. Parathion 3·2 oz. per 40 gallons watered with rose cans.
- 2. Parathion 3·2 oz. per 40 gallons sprayed, to be repeated at intervals of 10 days.
- 3. Control (no treatment).
- 4. D.D. at 25·9 gallons per acre.

Soil samples from the top 6" layer from the differently treated plots were taken. From funnel catches taken out of these soils, the number of eelworms for 20 grams was estimated as below :—

TABLE L—Eelworm observations in experimental plots

LOCALITY	Date of treatment	Date of observation	D.D.	Parathion	Control
Coovercolly	... 9/10-1-1952	23-1-1952	8	2	22
		26-2-1952	4	16	22
Chaudicadoo	... 17/18-1-1952	27-2-1952	0	42	30

The data obtained are not adequate to form any correct conclusions. This experiment will be pursued during the next season and results reported. As regards the spray trials, there was no apparent result and requires repeating. With the knowledge that certain plants can be used as trap crops of ant injuriously to certain nematodes, it has been planned to lay experiments on those lines.

V. ROBUSTA PULPING EXPERIMENTS

Balehonnur

68. The experiments on the preparation of parchment from robusta fruits were carried out in the month of January, one for finding out an easy and quick method for fermenting the parchment and another to assess the economics of preparing robusta parchment. In the former experiment, it was noticed that the wet parchment treated with wood ashes at 6 oz. per bushel washed earlier and easier than the Controls, the temperature of the treated ones always being higher by about 2°C. than in the untreated ones. One important variation observed this year was that as against 36 to 39 hours required for washing the parchment last year, it occupied 87 to 92 hours this year. The reason for this was attributed to the very sticky mucilaginous material in the cherry this year. This point will be investigated during the next harvest season.

69. In the laboratory, a study of the pH values of the mucilaginous matter adhering to the robusta parchment while it was allowed to ferment, was conducted which showed that there was a steady fall from the initial value of pH 6.0 to pH 4.1 in the course of about 48 hours after which it was constant throughout till the parchment was ready for washing on the fourth day.

70. The double disc pulper with special copper covers attached to it was found to give more satisfactory execution.

71. For the latter experiment, the cost of preparation of clean coffee by the wet and dry processes from equal quantities of fruits has been worked out. For this purpose, two lots of $12\frac{1}{2}$ bushels of robusta cherry were taken. One lot was pulped to prepare parchment and the other dried in the cherry. The cost involved for each operation and the realizations from each process were calculated. The following statement gives the details of these observations :—

A. 1. Quantity of wet parchment from $12\frac{1}{2}$			
	bushels of cherry	...	5 bushels.
2.	of floats from —do—	...	11 lb.
3.	of dry parchment —do—	...	149 lb.
			(4 bushels, 21 srs.)
4.	of <i>goondloo</i> that passes through the pulper into parchment	...	4 lb.
5.	of <i>goondloo</i> that passes through the pulpur into skins	...	63 numbers.
6.	of clean coffee from dry parchment	...	113 lb.
7.	—do— from floats and <i>goondloo</i>	...	3 lb. 11 oz.
8.	Total clean coffee from $12\frac{1}{2}$ bushels of cherry (parchment).	...	116 lb. 11 oz.
B. Total clean coffee from $12\frac{1}{2}$ bushels of cherry (dried cherry):			
		...	129 3/7.

Making allowance for the difference between the valuation reports of the Mysore Coffee Curing Works and the calculated value, it was found that the total value of the clean coffee obtained from the robusta parchment prepared from $12\frac{1}{2}$ bushels of cherry would be 64.22 points. The value of clean coffee obtained from $12\frac{1}{2}$ bushels of dried cherry was 61.4 points making a difference of 2.82 points. The cost involved in picking, pulping and preparing the robusta parchment and the cherry are as follows :—

	Parchment			Cherry				
	Rs.	A.	P.	Rs.	A.	P.		
The cost of picking 600 lb. of cherry								
@ Re. 0-12-0 per woman	...	4	8	0	4	8	0	
Outturn pay on 6 women labourers								
@ Re. 0-0-9 per labourer	...	0	4	6	0	4	6	
To cost of labourers engaged for pulping								
($\frac{1}{3}$ of total spent on the day)	...	1	2	10				
To cost of labour engaged for washing and								
drying	...	2	0	10				
To cost of drying cherry	...				2	10	0	
TOTAL	Rs.	...	8	0	2	7	6	6
Excess cost involved in making parchment :						0	9	8

Chethalli :

72. Freshly picked ripe fruits of robusta were pulped in the McKinnon 4-disc pulper and the parchment was fermented as per the following treatments :—

1. Control—dry fermentation for 36 hours.
2. Soaked in at least 4 times its bulk of water for 36 hours.
3. Citric acid 1 oz. in 40 gallons for 36 hours.
4. Oxalic acid 1 oz. in 40 gallons for 36 hours.
5. Common salt $\frac{1}{2}$ oz. in 40 gallons for 36 hours.

It was not possible to wash the parchment in the case of control sufficiently free of the slime with the result that the parchment retains some dull brown colour. In the rest of the treatments where the fermentation was taking place with plenty of water, the washing was fairly complete. There was no noticeable difference between the plain water and the chemically treated lots.

73. In another trial, two lots of 4 bushels of fruit each were soaked for 12 hours in (1) water and (2) salt water respectively. These pulped easily, but after 36 hours under-water fermentation both did not give the desired colour of the parchment

VI. EXTENSION SERVICE

74. The Liaison Officer toured for 136 days during the year and visited 175 estates in

- (1) The Shevaroy's,
- (2) Nelliampathies,
- (3) Pulni and Sirumalai hills,
- (4) The Nilgiris (eastern and southern fringes),
- (5) Wynaad-Malabar,
- (6) Manjarabad,
- (7) Koppa,
- (8) Balehonnur,
- (9) Sangameshwarpet and
- (10) Bababudangiris.

During his tours he addressed seven gatherings besides suggesting (1) measures to prevent the soil erosion and leaching of soils, (2) provision of suitable shade for different localities, (3) spraying with Bordeaux mixture against leaf disease, (4) control of coffee stem borer with Benzene-hexachloride, (5) measures for combating green bug with H.E.T.P. or fish-oil-rosin soap fortified with rosin dissolved in soda ash. Many of the advices given in person were later confirmed in writing.

VII. MISCELLANEOUS CROPS

75. **Paddy.** Paddy was grown in the wetlands at both the stations during the year. The details of harvest are furnished below.

	Area. (Acres)	Grains (seers)	Straw (lb.)
Balehonnur :			
1st crop	1.67	1653 $\frac{3}{4}$	4000 (approx)
2nd crop	1.67	1015	4000 (approx)
Total		2668 $\frac{3}{4}$	8000 (approx)
Chethalli :			
Single crop.	6.00	5113	17416 (approx)

76. **Oranges.** As already mentioned earlier, the blossom showers received in March 1951 were very satisfactory for orange and the crop was the best yet. The 1951-52 crop was sold to a private party on agreement for Rs. 6,750 and a further sum of Rs. 80 was realized by the sale of 4000 oranges to the officers and staff of the two stations.

77. Green manures.

(a) *Balehonnur.* Specimen plots of the following green manure plants were continued.

<i>Crotalaria anagyroides</i>	<i>Sesbania speciosa</i>
<i>C. usaramoensis</i>	<i>S. aculeata</i>
<i>C. striata</i>	<i>S. aegyptiaca</i>
<i>C. Grahamiana</i>	<i>Desmodium gyroides</i>
<i>C. Brownei</i>	<i>Desmodium ovalifolium</i>
<i>C. formosa</i>	<i>Stylosanthes gracilis</i>
<i>Tephrosia candida</i>	<i>Canavalia ensifolius</i>
<i>T. vogelii</i>	<i>Stizalobium</i> sp.
<i>Calapogonium mucunoides</i>	<i>Centrosema pubescens</i>

Seeds of *Desmodium gyroides*, *D. ovalifolium*, *Stylosanthes gracilis*, *Canavalia ensifolius* and *Stizalobium* sp. were obtained from the School of Agriculture, Peradeniya, Ceylon, and seeds of *Crotalaria formosa* from Korakundah estate, Nilgiris.

(b) *Chethalli.* The following green manures were sown and raised in about 2 acres of the 1951-52 clearings as rows across the Counter as a soil wash preventive.

<i>Crotalaria usaramoensis</i>	<i>Sesbania speciosa</i>
<i>C. grahamiana</i>	<i>S. aegyptiaca</i>
<i>C. agatiflora</i>	<i>Indigofera arrecta</i>
<i>Tephrosia candida</i>	<i>Cassia hirsuta</i>
<i>T. vogelii</i>	<i>Wild Dhaincha</i>

In addition to these, the very popular *Crotalaria anagyroides* was sown and raised in the remaining 5 acres of the 1951-52 clearings. Since sowing these green manures in Aug-Sept. 1951 three cuttings were taken by the close of the year under report. The following quantities of seeds from the various green manures raised at this station were collected.

<i>C. anagyroides</i>	... 408 lb.
<i>C. agatiflora</i>	... 5 lb.
<i>T. candida</i>	... 5 lb.
<i>T. vogelii</i>	... 1 lb.
<i>S. speciosa</i>	... 7 lb.
<i>S. aegyptiaca</i>	... 6 lb.
<i>Cassia hirsuta</i>	... 5 lb.

Seeds varying from a few ounces upto half a pound were collected from the other green manures raised at this station. By sale of green manure seeds, the bulk of them being *C. anagyroides*, a sum of Rs. 214-13-0 was

realised during the year as against Rs. 251-4-0 in the previous year. The drop in revenue is mainly due to many planters raising their own green manures round about this area.

78. Cotton:

(a) *Sea Island cotton*: *St. vincent* and *Montserrat* have a tendency to flower and set fruits during the rainy months from June to October. The bolls formed, readily rot in the rainy months.

(b) *Moco* and *Queberdinho* (perennial cottons) plants have produced vigorous growth. They have grown to a height of 12 ft. and have covered the ground though planted at 6 ft. x 6 ft. They commenced flowering from Sept-Oct. and their harvest continued till April. The total quantity, 6½ lb. of keppas collected was utilized for preparation of seed. Eight ounces of seeds from each variety have been reserved for supplies to the Economic Botanist, Bangalore. The remaining seeds were sown in the nursery.

79. **Tung oil.** At Balehonnur, 60 tung oil plants planted amidst coffee are growing well. Some of the plants have grown upto 18 ft. and have produced flowers during May-June 1952 and fruits are developing. At Chethalli, all the plants in the 1949 and 1950 clearings are growing well. For the first time since planting most of them are in flower from April onwards.

80. **Shade trees.** *Maesopsis eminii* raised from seeds obtained from Kenya, are making satisfactory growth, and have grown upto 18 ft. in height with similar spread in three years. The plants are evergreens and they give light shade for coffee. To test their performance further in all the coffee districts of S. India, 10 lb. of seeds were obtained from the Forest Officer, Nairobi and 9 lb. were distributed to planters in Mysore, Coorg, Nilgiris, Shevaroy and Tinnevelly.

Erythrina tomentosa, also an exotic species, has proved to be unsatisfactory. Instead of growing erect, it makes poor growth. Unlike *E. lithosperma* the plants are thorny and are readily affected by insects. Seedlings of *Cordia myxa* and *Trewia nudiflora* planted last year are making slow growth. The older plants of *T. nudiflora* have produced fruits for the first time.

VIII. FARM MANAGEMENT

81. Both stations continued to be subscribing members of the U. P. A. S. I. and its labour department, and also of the regional Planters' Associations. The average strength of labour and their turn out during the period were as follows.

	Labour On 1-7-51	strength. On 30-6-52	Average turnout.
Balehonnur	106	114	79.95
Chethalli	114	93	88.0

82. **Medical facilities.** As in the previous years, medical facilities at both stations were provided by the part-time services of the local medical officers of the Mysore and Coorg administrations. The health of both stations was on the whole good. The anti-malarial squads of the local administrations attended to D. D. T. spraying of all estate quarters.

83. **Borer control.** Following is the number of borer infested trees removed :—

	Acreage under			
	Arabica.	1949-50	1950-51	1951-52
Balehonnur	111	5150	5320	4580
Chethalli	87	9316	5997	5523

84. **Harvest.** Following are the harvest figures of coffee for the two stations.

ARABICA					ROBUSTA				OTHER COFFEE	
	Bushels	Srs.	Seed coffee lbs.		Bushels	Srs.	Seed coffee lb.		Bushels	Srs.
Balehonnur :										
a. Parchment	...	670	21	650 12	100	14	45 1		...	...
b. Dry cherry	...	476	...	...	86	18	...		19	16
c. Gleanings	...	133	24	...	18	22	...		...	...
Total	...	1280	17	650 12	205	26	45 1		19	16
Yield of clean coffee	...	...	...	...	14.38 tons			...	...	...
Chethalli :										
a. Parchment	...	361	...	...	57	...	...		...	...
b. Dry cherry	...	77	...	...	24	...	...		...	...
c. Gleanings	...	36	...	...	...	...	...		...	...
Total	...	474	...	...	81	...	...		...	...
Yield of clean coffee	...	...	...	...	5.85 tons			...	...	...

IX. GENERAL

85. **Trials with spray nozzles.** Two Broadway spray nozzles fitted with swirl plates, washers and discs of the following design were received from Messrs. Darragh Smail & Co. Ltd., Alleppey :—

1. A fine spray nozzle with 4 hole swirl plate medium washer and No. O disc.

2. A medium spray nozzle with 6 hole swirl plate medium No. 1 disc.

The spraying tests were conducted using a John Bean's power sprayer. It was noted that with O disc, in 4 minutes under 150 lb. pressure, $2\frac{1}{2}$ gallons could be sprayed while with No. 1 disc $3\frac{1}{2}$ gallons was sprayed during the same period. There was not much difference in the number of bushes covered. Atomization of the liquid was better with O disc and there was good coverage of the leaves as in the case of No. 1 disc. Comparatively less volume of the spray liquid was used with O disc which was nearly 60 per cent of the liquid necessary with No. 1 disc. The drip of spray liquid from bushes sprayed with No. 1 disc was more than with O disc.

86. **Meteorology.** Two thermo-hygrographs have been installed, one under coffee shade and the other in the open in the observatory for collection of humidity and temperature records for the micro and macro climates respectively. Mean weekly maximum and minimum temperatures and humidities were tabulated from the charts for the year. The records are represented in two graphs and the following are the salient points observed. The two maximum and the minimum curves run parallel to each other, except for small fluctuations. Maximum temperatures in the open on the observatory are invariably greater than under shade. Vice versa are the trends with the minimum temperatures except in December-January when the minimums under shade register a small fall. The differences between the maximum and minimum temperatures both under the micro and macro climates are the least

during the S.W. monsoon period June to August. From November to April *i.e.* during dry weather, they are wider. Mean maximum is the highest in April and lowest in August. Minimum is at its lowest in December and highest in July.

87. Maximum humidity in the open is higher than under shade from June to September corresponding to the S.W. monsoon period and lower than under shade during the dry period from October to March. In April and May there are fluctuations brought about by the changing conditions and hot weather showers. The two minima almost run parallel to each other, readings under shade giving generally higher values. The minima under shade and in the open are almost equal from July to September except for small fluctuations. The differences get wider during the dry weather from October to April. Highest maximum humidity in both situations occur in July-August and the lowest in January-February. The highest maximum temperature in the open is 90°F. and the lowest 55°F. Under shade these are 88°F. and 53°F. respectively. With humidity, the highest is 98 in the open and the lowest minimum is 15. Under shade they are 96 and 30 respectively. The minimum humidities are invariably higher under shade than in the open.

88. **Conferences and Exhibitions.** The Research Department participated in the U.P.A.S.I. exhibition and conference at Coonoor during August 1951.

89. **Publications.** Following contributions were made to *Indian Coffee* :—

1. The Multiple stem of trainig coffee ... By K. M. Thomas.
2. Soil conditions and Plant growth in relation to coffee ... By Dr. N. G. Chokkanna.
3. Agronomics of Arabica coffee clearing... By S. Sundaram.
4. Leaf disease and its Importance in Coffee ... By R. L. Narasimhawamy.
5. Glimpses of Shevaroy's Coffee ... —do—
6. Liaison Service & Coffee Improvement. By T. V. Pattabhiraman.
7. A Coffee Nursery in Coorg .. By James Colaco.
8. Three quarterly reports of the Research Department ... By K. M. Thomas.
9. Liaison Reports ... By T. V. Pattabhiraman.

A leaflet '*Planting Practices in Coffee*' By R. L. Narasimhaswamy, was issued as Leaflet No. 4.

90. **Ad hoc committees.** Five meetings of the *ad hoc* committee for Balehonnur and three meetings of the *ad hoc* committee for Chethalli were held during the year. Due to want of quorum, two informal meetings at Balehonnur and one at Chethalli were also held.

91. **Staff meetings.** Five staff meetings were held during the year at Balehonnur at which budget allocation, priority of work, manuring schemes, spraying of the estate and other cultural operations, planting of new areas etc. were discussed.

92. **Library.** Thirty-seven journals were subscribed for besides 14 journals received on an exchange basis. Eighty-five books were added to the library. Photo-copies of important articles the originals of which are not available, were obtained. Loose numbers of journals were got bound into volumes. The total expenditure on library was Rs. 3,104-11-8.

93. **Correspondence.** The number of correspondence dealt with during the year was as follows :—

	Balehonnur.	Chethalli.
Number of letters received ...	6,753	1,471
Number of letters despatched ...	7,421	2,183

94. **Audit of Accounts.** The audit of the accounts of the Research Department was done by the Government auditors.

95. **Acknowledgements.** It is with pleasure that I record the kindness and consideration which I have received from the members of the Board. To the various grades of executive and ministerial officers at the two Research Stations, I express my thanks for their co-operation and unstinted hard work. To many scientists in India and abroad who exchanged their publications with me and to those firms who have given me generous samples of their insecticidal and fungicidal products, I have to record my thanks. To the planting community who have placed at the disposal of the department their knowledge and problems and above all for their traditional generosity and hospitality to me and to my staff alike, I express my grateful thanks.

K. M. THOMAS,

Director of Research.

APPENDIX I**LIST OF STAFF AS ON 30-6-1952****Balehonnur****Messrs.**

1.	K. M. Thomas, B.A., M.Sc., D.I.C. (Lond).	... Director of Research
2.	N. G. Chokkanna, M.Sc., Ph.D. (Breslau).	... Chemist
3.	S. Sundaram, B.A., B.Sc. (Agr). M.Sc.	... Agronomist
4.	R. L. Narasimhaswamy, M.Sc.	... Asst. Botanist
5.	S. V. Kuppaswamy, B.A.	... Asst. Chemist
6.	S. G. Karwar	... Head Clerk Accountant
7.	A. B. Achia	... Mechanic
8.	L. V. Vaidyanathan, B.sc.	... T/Research Asst.
9.	T. H. Thimme Gowda	... Farm Asst.
10.	O. K. S. Panickar	... Clerk
11.	P. G. Sundareswaran	... Typist/clerk
12.	T. A. Varughese	... Accts. Clerk
13.	H. Krishnamoorthy	... Clerk
14.	K. Gopi Menon	... Fieldman
15.	P. Balarama Menon	... Fieldman
16.	V. T. Kochumathew	... Clerk
17.	A. Muthukumaraswamy	... Temporary Fieldman
18.	N. S. Venkateswaran	... Temporary Fieldman
19.	M. K. Visweswara	... Temporary Fieldman
20.	Seshiah	... Temporary Laboratory Attender
21.	Y. Koju	... Permanent Laboratory Attender
22.	N. K. Govindan	... Peon
23.	Devaiah	... Peon

Messrs.**Chethalli Sub-Station**

1.	T. V. Pattabhiraman, B.Sc. Ag.	... Liaison Officer
2.	James Colaco, B.Sc. Ag.	... Superintendent
3.	M. K. Aiyapa	... Clerk
4.	P. Thomas	... Clerk
5.	A. T. Chengappa	... Fieldman
6.	K. K. Ramachandra Rao	... Fieldman
7.	I. B. Belliappa	... Fieldman
8.	A. Freddy	... T/Peon

CONTINGENT EMPLOYEES**Balehonnur**

*1.	Sri Kunhiraman	... Temp. Van Driver
2.	„ V. Ramakrishna Bhat	... „ Mech. Attender
3.	„ H. S. Venkataramana Bhat	... „ T. B. Attender
4.	„ O. K. Devassy	... „ do

Chethalli

1.	„ Paul D'Souza	... Temp. Mech. Attender
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APPENDIX II

Rainfall record of the Coffee Research Station, Balehonnur (Mysore)

MONTH	RAINFALL RECORDED IN INCHES DURING										Average for 10 years	Rainfall recorded in 1951-52 in inches
	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51		
July 1951	32.16	49.95	47.43	41.61	37.52	35.80	35.97	30.93	24.60	58.25	39.02	29.31
August	21.31	20.14	9.89	10.09	10.72	37.93	30.34	39.49	25.52	20.11	22.55	19.40
September	5.34	5.39	16.11	2.92	9.11	11.51	9.80	6.43	14.80	21.12	10.25	9.77
October	8.76	7.18	15.29	12.42	4.25	3.56	2.62	6.80	7.99	6.43	7.53	6.74
November	0.21	0.21	2.53	2.71	1.08	7.04	1.14	8.59	1.43	1.27	2.62	3.12
December	2.22	1.87	0.01	0.07	0.00	1.09	0.91	0.08	0.00	0.00	0.63	0.00
January 1952	0.00	0.47	0.03	0.00	0.00	0.36	0.26	0.00	0.02	0.00	0.11	0.14
February	0.00	0.00	1.00	0.00	0.03	0.00	0.00	0.00	0.74	0.00	0.18	1.50
March	0.00	0.15	0.60	0.00	0.52	1.86	0.19	0.44	0.00	0.53	0.43	0.00
April	4.63	2.06	1.04	3.92	9.05	1.56	9.94	2.16	0.79	3.84	3.90	6.29
May	5.49	11.76	5.78	2.73	4.28	5.21	2.41	6.61	3.77	8.43	5.65	2.55
June	19.52	13.47	7.81	8.65	23.53	9.90	15.67	10.50	11.57	17.88	13.85	13.53
	99.64	112.65	107.52	85.12	100.09	115.82	109.25	112.03	91.23	137.86	106.72	92.35

APPENDIX III

Rainfall record of Coffee Research sub-station, Chethalli (Coorg)

MONTH	RAINFALL RECORDED IN INCHES DURING										Average for 10 years	Rainfall in inches during 1951-52
	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51		
July	...	16.06	26.93	31.45	36.00	30.84	10.71	23.35	12.43	15.35	23.17	20.86
August	...	12.91	12.29	4.69	4.93	7.64	24.91	18.85	21.51	8.83	12.57	6.33
September	...	6.36	3.91	8.91	1.83	3.50	8.25	8.64	3.59	5.87	6.47	9.54
October	...	4.22	5.84	11.50	6.04	4.63	3.93	9.98	3.64	8.85	6.18	6.38
November	...	1.42	0.42	6.55	4.00	2.09	6.16	0.13	5.22	0.10	3.1	3.28
December	...	1.88	1.01	0.00	0.51	0.00	2.31	1.05	0.09	0.00	0.68	0.00
January	...	0.00	1.24	0.00	0.00	0.00	0.00	0.50	0.03	0.00	0.17	0.00
February	...	0.00	0.16	1.05	0.00	0.00	0.72	0.40	0.00	0.71	0.30	0.09
March	...	1.78	0.42	0.33	0.00	2.02	0.00	0.00	0.02	0.00	0.67	0.00
April	...	3.02	2.16	0.87	7.38	8.32	1.53	4.75	3.78	1.18	3.55	4.37
May	...	8.55	11.78	1.40	2.29	1.35	4.69	3.80	11.02	3.71	5.27	3.09
June	...	14.77	9.10	7.02	10.35	13.59	7.31	10.53	6.85	6.83	9.53	8.36
Total	...	70.97	75.26	73.77	73.33	73.98	70.52	81.98	68.18	51.43	71.66	62.30

APPENDIX IV

Meteorological data of the Coffee Research Station, Balehonnur (Mysore) during 1951-52

Sl. No.	METEOROLOGICAL OBSERVATIONS	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June
1.	Highest maximum temperature 0°F	...	82.0	80.5	84.5	85.0	84.2	84.5	85.7	88.5	92.0	93.2	91.5
2.	Lowest maximum temperature 0°F	...	65.0	70.5	73.5	70.5	75.5	77.5	78.6	80.5	83.0	84.5	72.5
3.	Highest minimum temperature 0°F	...	68.0	67.5	67.0	67.5	67.4	66.0	63.5	68.5	65.4	70.0	70.5
4.	Lowest minimum temperature 0°F	...	63.0	60.0	60.6	61.0	59.5	52.4	52.4	57.5	57.5	60.0	60.5
5.	Average maximum temperature 0°F	...	75.7	74.3	79.4	79.8	80.9	79.3	82.2	85.2	88.0	89.1	84.0
6.	Average minimum temperature 0°F	...	65.4	65.4	65.3	64.9	65.5	56.9	58.6	61.2	61.6	63.8	66.0
7.	Hi es number of hours of bright sunshine	...	5.30	9.48	9.30	8.00	10.24	10.12	10.42	10.36	11.00	10.30	11.3
8.	Lowest do do	...	0.00	0.00	0.00	0.54	1.18	5.12	5.30	4.12	8.00	4.00	0.00
9.	Average do do	...	1.40	1.55	4.49	5.25	8.00	9.30	8.56	8.02	9.32	7.17	5.55
10.	No. of days on which rainfall was below 10 cents	...	7	1	3	3	3	...	2	1	...	5	5
11.	— do — between 10 and 50 cents	...	8	5	12	4	2	...	...	1	...	6	6
12.	— do — between 50 and 100 cents	...	7	12	...	5	1	...	...	...	...	1	2
13.	— do — between 1 and 2 inches	...	4	3	2	2	1	...	...	1	...	3	...
14.	— do — above 2 inches	...	5	2	2	...	...	...	...	...	...	...	...
15.	Total rainfall for the month	...	29.31	19.40	9.77	6.74	3.12	...	0.14	1.50	...	6.29	2.55
16.	Number of rainy days during the month	...	31	23	19	14	7	...	2	3	...	15	13
17.	Highest rainfall during the month	...	6.42	2.68	2.37	1.51	1.56	...	0.09	1.27	...	1.57	0.56

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